DOCUMENT RESUME

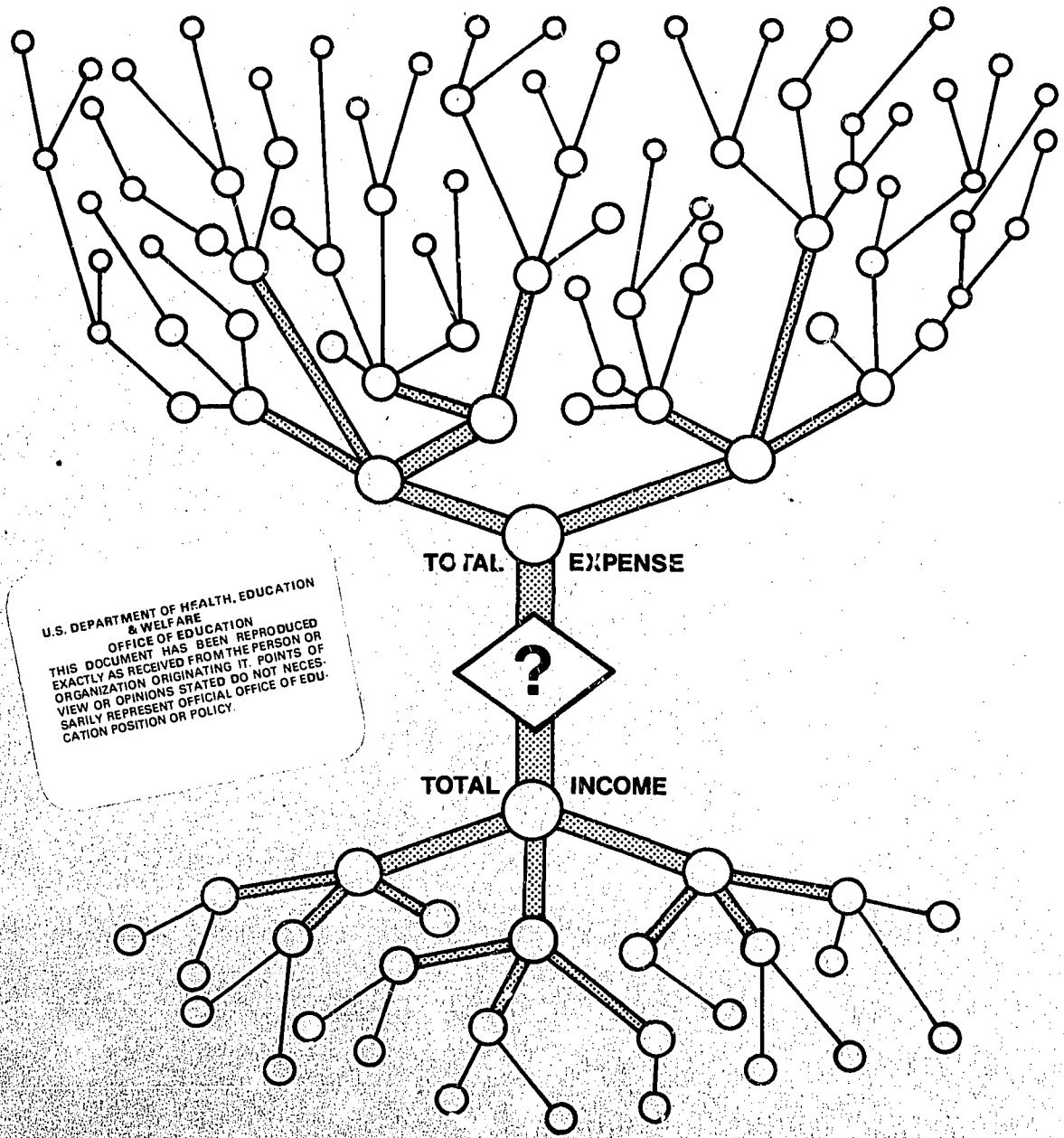
ED 048 824 HE 002 048

TITLE	HELP/PLANTRAN; A Computer Assisted Planning System for Higher Education.
INSTITUTION	Midwest Research Inst., Kansas City, Mo.
PUB DATE	Dec 70
NOTE	130p.
EDRS PRICE	EDRS Price MF-$0.65 HC-$6.58
DESCRIPTORS	*Computer Oriented Programs, Educational Planning, *Higher Education, *Models, *Planning, Simulation, *Systems Approach
IDENTIFIERS	*PLANTRAN

ABSTRACT

Chapter I of this manual for a planning simulation system for higher education presents some basic outlines to aid in the planning process, including the "outline of plans" as a concrete aid to systematic planning. This chapter also identifies some of the typical problems and barriers that hamper the planning process, and conveys the need for a structured planning approach. The second Chapter discusses simulation and modeling, and the third the modeling language. Basic elements of PLANTRAN are described in Chapter 4 and examples of model design are presented in Chapter 5. Chapter 6 discusses generating alternative plans with use of a System Driver, and Chapter 7 presents a summary. PLANTRAN exercises, a sample college model, and identification and description of error messages and common data errors comprise the appendices. (AF)

ED048824



U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

HELP/PLANTRAN

A COMPUTER ASSISTED PLANNING SYSTEM FOR HIGHER EDUCATION

MIDWEST RESEARCH INSTITUTE
425 VOLKER BOULEVARD
KANSAS CITY, MISSOURI 64110

MRI

HE002043

ED048824

HELP/PLANTRAN

A SIMULATION MODELING SYSTEM FOR PLANNING

Developed by

Economics and Management Science Division
Midwest Research Institute

1970

PREFACE

American technology seems to thrive on the solving of problems so long as these problems are of a purely physical nature. We can mass produce things in copious quantities. We can send men a quarter of a million miles through space and land them within several hundred yards of a pinpoint target on the moon. These are problems that largely yield to the laws of mathematics, physics, and chemistry. We seem not to be able to cope so well with problems that have a human element.

One of the magnificent tools our technology has given us is the electronic computer. Unfortunately, the prophecies of a "revolution in management" to be made possible by this new miracle machine have gradually led to adverse reaction and disillusionment.

It is our thesis that this disillusionment is not due to any lack of potential or lack of capability of the computer. Rather, it is a human shortcoming--a lack of capability in designing systems that simultaneously exploit the power of the computer and executive brain power. This shortcoming has been characterized by the application of computers to supplant rather than augment human capabilities.

Thus there has been an abysmal gap between the immense power of the electronic computer and some very real and difficult problems. The planning problem faced by upper level executives, particularly long-range planning, is one example.

There has been recent interest in the application of computers and simulation to planning. Early attempts to solve, or at least to work with, planning problems by using computer planning techniques have been criticized for a number of reasons, many of them valid. Some techniques were so simple as to be almost trivial, while others were so complex that they required too much technical expertise on the part of the users or a large staff of specialists.

The system presented in this manual is a completely new approach to planning. With this system, the people who are most affected by the results of the planning--the administrators, the executives, the faculty members--become the model builders and can take an active role in the planning effort.

The system requires no technical expertise--it uses a simple language that is almost exactly the same as the clerical instructions that some planners are using now in manual methods. This simple language is presented to a computer compiler, which then translates the information

into computer terms. The information is processed by the computer, and the results are presented in a format set by the user. This system never requires the planner to know or to understand any of the technical aspects of computers.

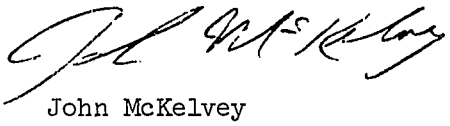
This manual has been designed not only to provide the essential information on the uses of the computerized planning system but also to serve as a primer on planning. An appendix containing exercises makes the manual highly self-instructional. We believe that a person will understand the fundamentals of planning and be able to use the planning system after only a few hours of studying this manual.

The computerized planning system described in this manual can be used on nearly all computers. The only requirement is that the computer facility have FORTRAN and COBOL compilers and sufficient core memory. This system has been used on the IBM 360, Burroughs B5500, CDC 6400, and other computers, and is currently in use by a number of colleges and universities.

Richard L. Salmon, Duane Dieckman, and Jeanne Robertson of the Economics and Management Science Division of Midwest Research Institute, aided by William D. Sutterfield of Park College, were responsible for developing this system. Valerie Lee of MRI made major contributions to the preparation and editing of this manual.

Approved for:

MIDWEST RESEARCH INSTITUTE



John McKelvey
Vice President and Director
Economics and Management Science Division

December 31, 1970 (Second Edition)

dgr

TABLE OF CONTENTS

ERIC

CHAPTER I

A SYSTEM FOR PLANNING

Planning is a decision-making process. It is a way for an organization or institution to meet expected change, produce desired change, and prevent undesired change. Today, more than ever before, educational institutions are subjected to increased pressures, demands, and constraints. If they are to survive and remain viable, they must be able to direct and control their own future.

The need for planning, then, is due to the changing environment, the complexity of operations, the ever-increasing requirements for funds, the increasing number and complexity of regulations, and the inadequacy of the old informal planning methods. It is no longer adequate nor wise to focus all the attention on immediate problems and let the future take care of itself.

Planning provides a systematic means for an organization or institution to develop a course of action to meet short-range and intermediate goals and needs as well as long-range goals and needs. In addition, the short-range needs--the problems at hand--can be satisfied within the framework of the long-range needs of the organization. An organization that has a carefully developed plan is in a position to anticipate and react positively to external events rather than to wait and be controlled. Finally, proper planning can give an organization a realistic understanding of its capabilities and resources and permit the organization to experiment with its resources to determine what must and can be done.

THE SYSTEM

The planning simulation system described in this manual is a powerful and useful tool to answer the characteristic "what if..." kinds of questions that frequently arise in formal planning. However, this system is no more than a powerful and useful tool. It must be used in a systematic way, within a structured context for developing alternatives--within a framework appropriate for policy and decision-making. The planning approach that is the setting for the simulation system is illustrated in Figure 1. This system consists of six basic steps, reinforced by analysis and review.

THE PLANNING APPROACH

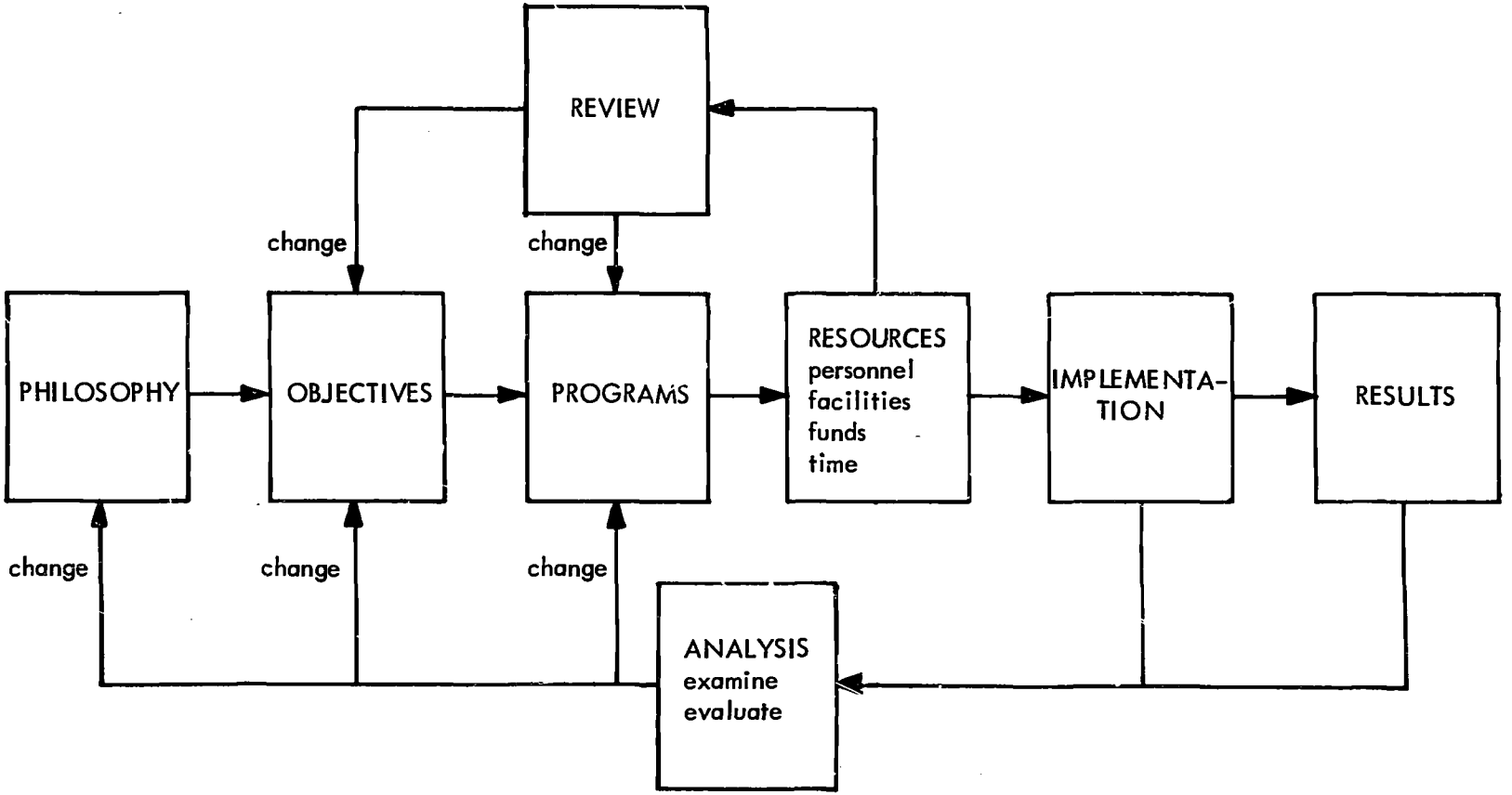


Figure 1

The first and by far the most fundamental consideration in planning for any institution or organization is a careful examination of the philosophy of the organization--the why, the raison d'etre, the mission. All decisions, plans, and acts must be consistent with the institutional philosophy.

Objectives are the second consideration in planning and relate to determining where the institution is now and where it desires to be at various points in the future. Consideration of objectives also aids in establishing priorities--deciding what is of immediate concern and what may be deferred.

Programs, the next consideration, are the logical product of the establishment of objectives. Programs cover what must be done to achieve the objectives, and the planners must determine both how and when the programs will be applied.

The fourth consideration--resources--brings reality into the planning process. Resources of personnel, facilities, funds, and time must be examined and matched with what is needed for the programs. Most often, the natural outcome of this matching will be changes in the programs and, quite possibly, in the objectives. These changes in the plan represent a very important step, for they determine what will actually be placed into operation. These changes may require that priorities be altered and that programs be modified; most surely time schedules will shift. The end result of these changes, however, will be much better if a systematic approach has been followed.

The fifth consideration--implementation--concerns execution of the plan. Responsibilities are assigned and all needed resources are provided for incorporating the plan into the organization. Throughout the implementation phase, the plan is analyzed, and results are continually examined, for it is almost certain that at least some small changes must be made to enhance the actual operation of the plan.

The final consideration--results--concerns accomplishments under the plan. Measurement of the results permits the planner to observe what works and--what may be more important--what does not work. The major benefit from evaluation of results is the analysis of the overall performance of the plan.

The final analysis of the overall plan is converted into changes that feed back into the planning approach, giving future phases of the plan a higher probability of success. Thus, this process of continuous examination and evaluation enhances the operation of the organization.

It is in these inner "review" loops (shown in Figure 1) that the simulation tool can materially assist planners in evaluating, hypothesizing, and exercising alternatives.

This discussion has implied that planning is a rather straightforward, simple process. Quite often, however, planning attempts produce negative responses in those who should be involved. Some common responses from those who are approached about planning include: "We've survived without planning this long; who needs it?," "It's too blue sky," "It's just another job and I don't have the time," "It won't change anything," "It's inflexible," and "I know we're not doing as well as we can now, but if only they would...." These, and similar, responses have been heard by almost everyone who has attempted to initiate a planning function, and in some instances, the criticisms have been valid.

To counteract these criticisms and to provide a strong basis for planning, the plan must incorporate several elementary principles. First, the planning process must be simple enough to be understood by all those who should be involved with it. The plan must be selective in placing proper emphasis on various elements, and it must be adaptable and flexible enough to accommodate change. The payoff of the plan, or the final benefit to be derived, must be visible and worthwhile to all who are working with the plan. Finally, the planning process must not involve complicated, tedious paperwork to convert the desired goals into meaningful programs. The following section discusses a planning outline that is based on these principles and is an extremely useful tool in the planning task.

OUTLINE OF PLANS

Planning provides a systematic means for an organization to develop courses of action to satisfy its needs. A suggested form to be used in outlining plans is shown in Figure 2. This form, or a similar form, provides a systematic aid to thinking through the planning process, from the statement of the problem in specific terms and identification of measurable goals to the development of clearly expressed, step-by-step milestones that lead to the achievement of the goals.

The first column of this form contains space for an identification and description of the problem. This description should be as complete as possible because most problems are complex, containing many different elements. Each element should be specifically stated as a component of the problem.

ERIC

OUTLINE OF PLANS

- ☐ Worksheet
- ☐ Discussion Draft
- ☐ Proposed Draft
- ☐ Approved Plan

Name of Institution or Department

Plan Date | Replaces Plan Of | Next Review Date

1. Urgent Need
2. Important Need
3. Moderate Need
4. Minimal Need

Index of Need

Index of Difficulty

1. Not Difficult
2. Moderately Difficult
3. Highly Difficult
4. Very Highly Difficult

Planning Subject	Problem Statement	Long Range Program Goals	Plan Of Action	Resource Identification And Development Plans	▽	▽	Composite Priority	Organizations Concerned With Planning, Decisions and Action	Five Year Program Objectives And Milestones By Years

The problem statement, in the second column, should be in quantified terms insofar as possible. Simply describing the subject further is not adequate. The problem implied in each element identified in the first column should be precisely set forth.

The next column provides space for a statement of the long-range goals for each facet of the planning subject. A specific period should be identified--10 years, 5 years, 3 years--and precise goals should be given in measurable, concrete terms. The goals must be defined to a degree that everyone involved understands fully what is to be accomplished.

The fourth column, entitled Plan of Action, concerns approaches and strategies. How is each goal to be accomplished? What methods are most appropriate, most feasible, and most promising? Consideration of these types of questions will provide the answers as to how the planning is to proceed.

In nearly all planning situations, there are other individuals, organizations, and agencies that have experience with the subject under consideration. They can assist in planning, identifying other resources, and refining strategies. These groups or individuals should be listed in the fifth column--Resource Identification and Development Plans.

The next column has space for listing other organizations with experience and responsibility for action in the problem area under scrutiny These organizations are frequently in a position to share in decision-making, implementation, and action. Participation by the members of these organizations will create in them a desire for the successful accomplishment of the objectives and will increase their willingness to cooperate.

The last column on the planning form, entitled Objectives and Milestones by Years, calls for a list of logical, feasible yearly objectives that grow out of the preceding columns and lead to the accomplishment of the long-range goals. The objectives reflect the progress from where the organization is now to where it wants to be. The objectives should be stated in quantifiable terms so that they can provide a yardstick for measuring progress toward the goals.

Of course, problems will occur in this planning approach. Probably the most frequently encountered problem will be delay. It seems that there is always someone or something that is not quite ready. Since the planning function seldom produces immediate results, other activities often seem to have higher priorities than planning activities. The importance of the planning must be constantly emphasized to keep the effort from becoming bogged down and forgotten among day-to-day activities.

Other barriers to the planning process include lack of top-level support and participation; trying to do too much, too quickly; not allowing time for those involved in the planning to learn about and understand the planning process; and over-emphasizing a specific portion of the planning task, such as long-range goals, data gathering, or some technical aspect.

THE DATA PROBLEM

Probably one of the most common arguments given against any type of quantitative planning is the lack of valid data. While the data requirements for the planning models considered in this system are not extensive, the facts are that most institutions find that they do not have even those data readily available. The argument then is: "Why plan when we don't have valid data?"

The answer is obvious. Some kind of structured approach to planning is mandatory. Systematic planning with scant data is preferable to no planning. Doing nothing is the worst possible type of planning. With planning, an institution can control its own course; without planning, the institution will be like a rudderless ship, controlled largely by external forces.

In developing models for planning, a fundamental question is: "Which comes first, the model or the data?" Obviously, it is neither feasible nor even necessary to collect every conceivable item of data that might at some time bear on institutional planning. The usefulness of a planning model lies in the fact that the critical data can be pinpointed and priorities can be set for data collection and information systems efforts. In gathering data, the rule should be: important data first, nice-to-know data later.

This chapter has presented some basic guidelines to aid in the planning process, including the "outline of plans" as a concrete aid to systematic planning. This chapter has also identified some of the typical problems and barriers that hamper the planning process. Most importantly, this discussion has tried to convey the need for a structured planning approach. These considerations are the most crucial aspects of the planning process. Yet the sheer drudgery of assembling, processing, and analyzing large quantities of data frequently reduces the effectiveness and usefulness of individuals engaged in the planning process. The following chapters offer a means of lessening the drudgery and enhancing the effectiveness of the planning function.

CHAPTER II

SIMULATION AND MODELING

With the development of the electronic computer, a new technique, simulation, has evolved as a practical aid to planning. This technique employs logic and mathematics in the construction of a computer simulation model that represents an organization's functions.

The term "model" may be defined as a representation of an object or a system, which is designed to look like or act like the real thing. There are several types of models. The type most everyone is familiar with is a physical model. This type of model looks like the item being modeled. Model airplanes, cars, trains, and the like are examples of physical models.

Another type of model most people are familiar with is a schematic model. These models are representations in pictorial form. They are abstract and their components (lines, symbols, arrows) are not found in the items they represent. Some examples of schematic models are blueprints, flow diagrams, organization tables, and wiring or electronic circuit diagrams.

A third type of model is a mathematical model. This model consists of a set of equations. The solution to the equations explains or predicts effects of changes. These models are an analytical effort to abstract and describe the real world. They are general, subject to manipulation, and precise in terms of the information gained from their use. These models may use basic mathematical operations--multiplication, division, and so forth--or more sophisticated mathematical formulae--regression analysis, correlation analysis, and the like.

The last type of model is the one we are most concerned with--a computer simulation model. A computer simulation model is simply a mathematical model that is expressed or written according to a particular set of rules, so that the model may be processed by a computer.

For planning purposes, the computer model will portray real or expected conditions in the operation of an organization. The representation will be based upon the planner's experience and observation of how the organization functions through time. The model will be constructed by assigning quantitative values and relationships to the elements, or planning items, that characterize the organization.

ERIC

We mentioned above that simulation is dependent upon a computer model to represent an organization's functions. Simulation is basically a technique for conducting experiments. It can be used to study problems where rules, policies, procedures, and other controlling aspects are under question and in which the number of variables and the uncertain nature of input make the problem difficult to analyze by conventional techniques. The products of simulation models are solutions to problems. Also, these experiments at problem solving provide a method of determining cause-and-effect relationships without actually experimenting with the organization.

A simulation model that accurately reflects the complex and dynamic interrelationships of organizational elements has several substantial advantages. The simulation model can:

- Stimulate the imagination and improve perspectives.
- Assist in designing, manipulating, and examining various alternatives.
- Facilitate communication among the people involved in planning and policy making by presenting a physical point of reference.
- Clarify and examine issues and focus effort on the major ones.
- Teach the planners and policy-makers how to plan better by permitting insight into patterns of crisis.
- Develop contingency plans and anticipate crises with planned action.
- Create methodologies, procedures, and frameworks for problem solving.

The answers that the experiments can provide permit sound policy decisions to be made with relative ease. As changes are noted, they can readily be incorporated into the model, keeping it viable and accurate in representing the organization.

This simulation system represents a unique approach. The approach itself is not a model but simply a system that planners can use to develop models. One important contribution to planning success is the capability to assess a large number of alternatives rapidly and accurately. This approach is designed to do precisely that.

ERIC

The concept underlying the system is similar in some respects to that of a conventional mathematical model that has been used by planners for years: the budget. (See Figure 3.) The computer planning model uses some of the same line items and adds to them other items--number of students, number of faculty, and so forth. (See Figure 4.) When the various elements of this model are projected into future years, the model simulates organizational behavior.

The following example illustrates the kind of situation in which computer simulation can be extremely helpful in quantifying and projecting the effects of change. In this example, the basic problem that the simulation model can be used to solve is: What will be the impact on student financial aid needs if a college increases its tuition and fees?

A small liberal arts college has forecasted a need to increase its tuition and fees by $600 over the next 5 years. This increase, of course, will provide the college with more income, but it will also affect other parts of the college's operation--particularly student financial aid. The most obvious effect is that additional funds will be needed simply to enable the percentage of students who are now receiving aid to meet the increased tuition and fees.

At present, 20 percent of the students receive some form of financial aid. As the tuition increases, however, it is quite likely that a greater proportion of students will be unable to pay the tuition and fees in full, so that a greater percentage of students will need financial aid. Simply stated, not only will the amount of aid for each student increase; the number of students needing aid will also increase. One result is that additional funds will have to be obtained from federal and other sources. Another result, however, may be that the size and the structure of the student financial aid office will have to be changed. For instance, if the percentage of students needing aid increases from 20 percent to 25 percent, more personnel may be needed to administer the student aid program. After all, for the student aid office the percentage increase in total number of students needing aid is not 5 percent but 25 percent. If additional personnel are needed, they may need more office space, and the financial aid operation itself will require additional funds for salaries, equipment, and expenses.

This simplified example shows how easily one apparently straightforward decision can quickly lead to a variety of other changes. It is in these kinds of rapidly pyramiding, cause-and-effect events that a computer simulation model can be most helpful. If appropriate information and data have been incorporated into the model (such as percentage of students needing aid, average amount of aid given, number of students served per professional employee), the computer can combine these figures with other

COMMON MATHEMATICAL MODEL IN COLLEGES

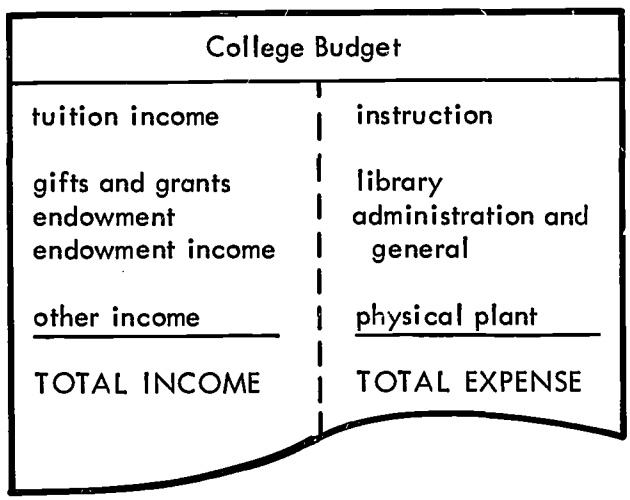


Figure 2

INSTITUTIONAL MODEL BASED ON BUDGET STRUCTURE

number of students

tuition

alumni

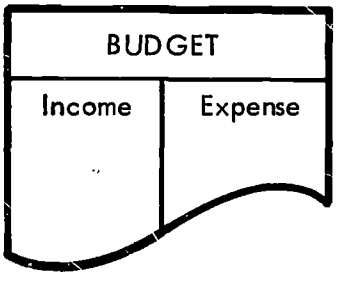
friends

corporations

special activities

investment portfolio

foundations and government



faculty and staff

departmental expenses

publications

travel

classrooms

square feet

library volumes

maintenance costs

Figure 3

figures on projected enrollment, future tuition, and other relevant factors and calculate the additional aid money and operating expenses at various points in the future. The computer will also incorporate these figures into the more general areas of the model, such as total income and total salary expense.

Such a computer simulation model can free administrators and planners from innumerable time-consuming and tedious calculations to determine the effects of various changes. In addition, the computer can effortlessly and accurately combine the thousands of bits of data that one change is likely to effect and produce an overall picture.

ERIC

CHAPTER III

THE MODELING LANGUAGE

The projections and interrelationships of planning items are handled by a simple planning language with a small vocabulary based largely on standard English. The language is called PLANTRAN, which stands for PLANning TRANslator. PLANTRAN is the basis of the planning simulator system.

In the discussion below, the term "variable" is used. Within this context variable has a special meaning. A variable is composed of a base value plus 10 period values, one value for each period of the planning horizon. The term variable is used to designate all the constituents of one line, or planning item, of the planning matrix. There are no fixed independent variables in the system. Variables that are independent in one model may be dependent in another. In some cases, a planner may insert a constant value line, or planning item. For our purposes, we shall call that line a variable also. Thus, all variables are specified by instructions in the PLANTRAN language.

THE PLANNING MATRIX

It may be useful to think of the planning vehicle as a matrix. Each row represents the projection of a planning item (variable) over a 10-period planning horizon. These projections may be simple extensions of a current or base value of an item, such as current AVERAGE SALARY projected with a 5-percent appreciation over a 10-year period. These are independent variables. Projections may also be functions of other planning items. For example, TOTAL SALARY EXPENSE might be derived and projected by multiplying AVERAGE SALARY by TOTAL STAFF. This type of projection is a dependent variable. It is the process of specifying each of these variables and determining how they are to be projected and how they are related to other variables that constitutes model building. The ease and simplicity of specifying each of the planning items belies the extreme complexity that the completed model may represent. The relatively simple static model is made complex by dynamic changes in planning items over time and even by dynamic changes in relationships among items.

Planners can use PLANTRAN to deal with individual planning items with ease and simplicity. At the same time, they may combine these items in an almost endless variety of ways to build a model of any desired complexity.

INDEPENDENT VARIABLES

Independent variables can be projected in one of four ways. These four methods are the most compatible with manual planning techniques:

1. CHANGE BY PERCENTAGE

   A variable may be changed (either increased or decreased) by a specified percentage each period. This projection is useful for handling variables that historically change by percentages. Example: Salary; increase 5 percent per year.

2. CHANGE BY AN INCREMENTAL VALUE

   The variable may be changed by a specified, fixed incremental amount each period. Often an item such as number of personnel is projected in this manner. Example: Research Assistants; increase 2 per year.

3. CHANGE TO A GOAL VALUE

   The variable may be changed to a specified goal value in a specified number of planning periods. This technique is useful both in determing and in evaluating goal-setting alternatives. Example: Fees; decrease to $50 in 4 years.

4. INSERT DATA

   The variable values may be known or follow a particular pattern. Any or all of the planning period values may be specified by the planner. This technique permits the constant value insertion mentioned above. Example: Reduction of indebtedness; 100000,0,0,10000,0,0,10000,...

DEPENDENT VARIABLES

The instructions provided for handling dependent variables are the basis of the power of the planning system. These dependent variable relationships may be designated in any one of five ways:

1. SUMMARY

The variable may be a simple summary of other uses. This technique permits totals, sub-totals, sub-sub-totals, and the like to be pyramided infinitely. Any number of other variables may enter into a summary variable.

2. FUNCTION OF OTHER VARIABLES

The variable may be a planner-specified function of other variables. This powerful technique permits the use of up to four variables, plus constant values, in combinations of addition, subtraction, multiplication, and division.

3. MAXIMUM OR MINIMUM OF OTHER VARIABLES

The variable may be the maximum (or minimum) of up to four other variables, period by period, across the planning horizon. This technique permits limits to be assigned to appropriate variables.

4. ACCUMULATION

The variable may be the accumulative summation of some other variable, period by period, across the planning horizon. This technique permits expenses, for example, to be accumulated through the planning periods. An option within this technique allows the variable to be the accumulative product of some other variables.

5. SHIFT ONE PERIOD

The variable may be a combination of a constant value times the value of another variable in the last period. This technique permits the shifting of a variable, or a constant value times the variable, one period along the planning horizon. The method can also be used as the basis for differentiating a variable over time.

HEADINGS

The final instruction in the PLANTRAN language permits headings to be inserted in order to organize and identify the various parts of the final computer print-out. In addition to identifying subdivisions, this capability also provides space for explanatory comments.

The instructions on independent variables, dependent variables, and headings may be used by the planner in an almost unlimited fashion. A variable may be built up by intermediate calculations and combinations of the instructions to produce functions of any desired complexity. By imaginative use of the modeling language, the planner is able to construct a wide variety of models.

PLANTRAN has been designed so that any planner, from the novice to the experienced professional, can use it easily and profitably at his own level. PLANTRAN is useful for the beginning planner; it is powerful for the experienced one.

CHAPTER IV

BASIC ELEMENTS OF PLANTRAN

In PLANTRAN, as in most other programming languages, the length of an individual instruction or statement is limited by the number of columns on a single punched card. If a statement exceeds the limit of one card (80 columns), a notation must be made to indicate that the statement is continued on the following card. In addition, certain characters have specific meanings and therefore are "reserved" in their use within a type of instruction. Three basic types of information can be entered into the model with the PLANTRAN language: identification input, instruction input, and summary report input.

IDENTIFICATION INPUT

The identification input is the simplest of the three. The purpose of this input is to identify the various parts of the plan. A sample of the plan identification sheet that is used for the identification input is shown in Figure 5. The sheet consists of five fields (the sixth field on the right side of the sheet is not used), each with a certain number of columns. The five fields and the data to be placed in each are:

Field 1--Columns 1-24, INSTITUTION. Contains the name of the institution.

Field 2--Columns 25-40, DATE. Contains the date of the plan.

Field 3--Columns 41-56, DESCRIPTION. Contains supplementary information.

Field 4--Columns 57-60, BASE YEAR. Contains the base year number.

Field 5--Columns 61-63, PLAN. Contains an identifying number of the plan.

The information that is entered on this sheet will provide headings to identify the plan and specific parts of the plan. In addition, the base year field provides the year, or period value, from which the planning horizon is identified. For example, if 1970 is inserted in the base year field, the planning horizon will reflect yearly values for the next 10 years: 1971, 1972, 1973...1980. If a time period other than a four-character year is desired, the value must be "right adjusted"; that is, it must be entered

PLAN IDENTIFICATION DATA SHEET

Name _____

Project _____

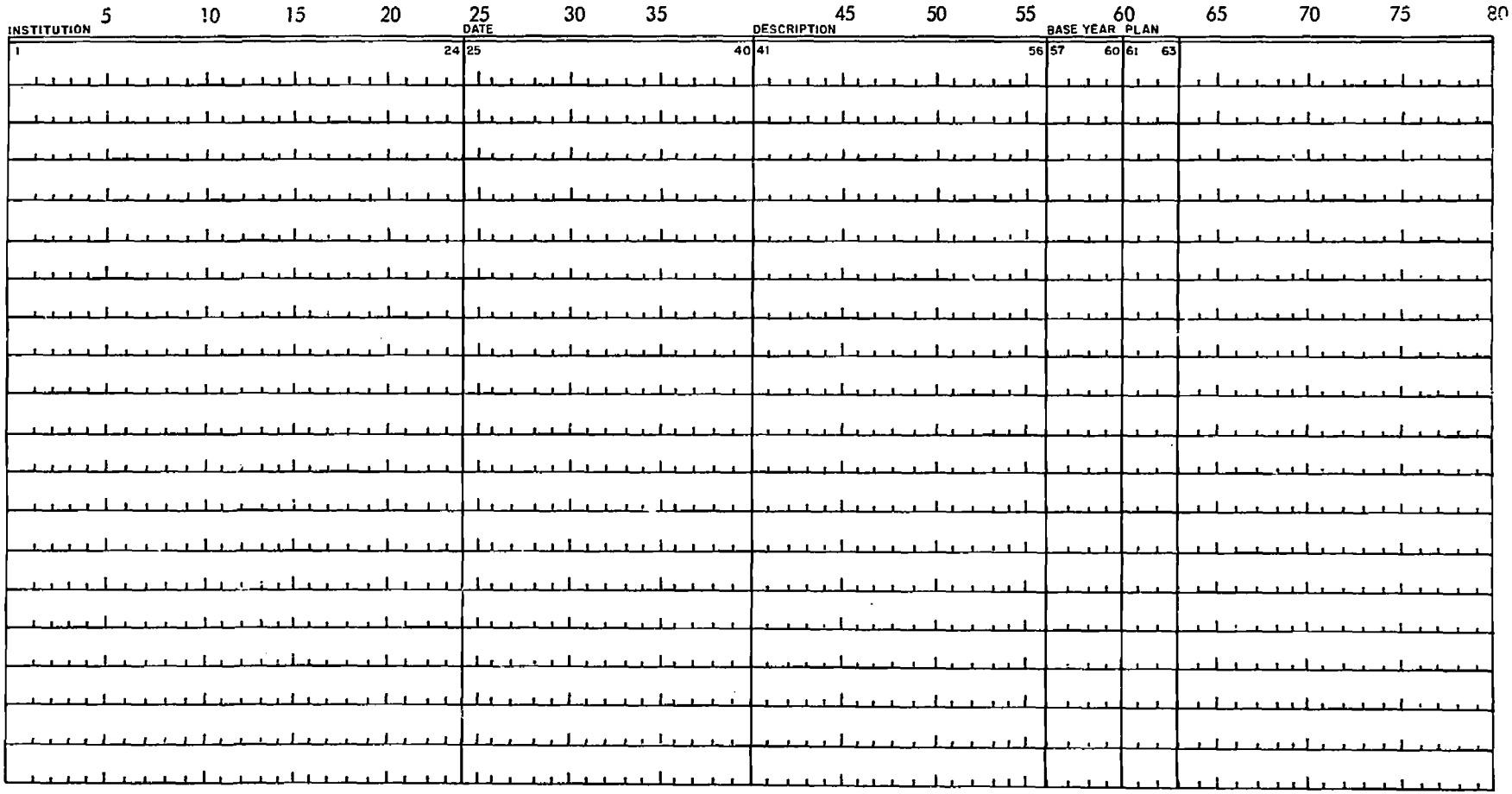


Figure 5

in the rightmost columns in the base year field. A unit of 1 is added for each period of the planning horizon.

INSTRUCTION INPUT

The second type of input involves the instructions to be used in the actual construction of the planning model. There are 10 different types of instructions and all use the format shown in Figure 6.

The instruction input format is divided into seven sub-sections, or data fields. The number of columns in each field varies, although all 80 columns are used.

Six of the data fields are basically the same, regardless of the type of variable, or planning item, that is being specified. The data fields, the numbers of the columns in each, and the type of data to be entered in each are:

Field 1--Columns 1-3, LINE NUMBER-(required). This field contains the line number associated with the planning item.

Field 2--Column 4, CHANGE IDENTIFICATION (optional). This field contains a number to identify a change associated within a planning item.

Field 3--Columns 5-32, PLANNING ITEM (optional). This field contains a description of the contents of the variable.

Field 4--Columns 33-40, BASE LEVEL (optional). This field contains the value for the base year or time period for the variable.

Field 5--Column 41, CODE (required). This field contains a code to indicate the technique to be followed to calculate the variable.

Field 7--Columns 78-80, SUM (optional). This field contains the line number of the variable to which variables on this line are summed.

The remaining field (Field 6) is the method field, or FREEFORM METHOD OF COMPUTATION. This field, in many respects, is at the heart of the system, because it is in this field that the planner specifies how the variable is to be projected. The following three sections discuss the instructions for projecting the three types of information: independent variables, dependent variables, and headings.

INSTRUCTION DATA SHEET

MRI

Name _____

Project _____

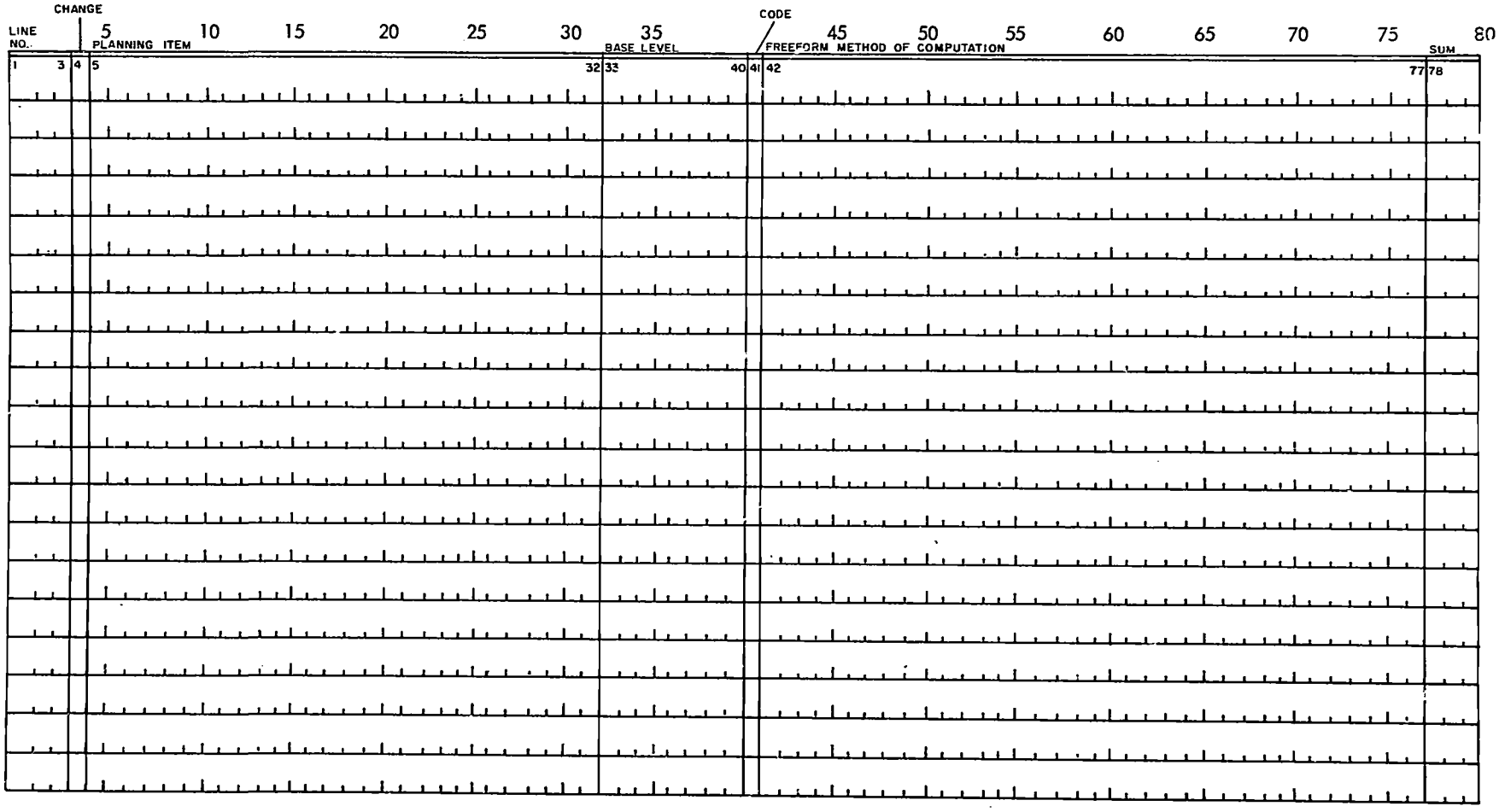
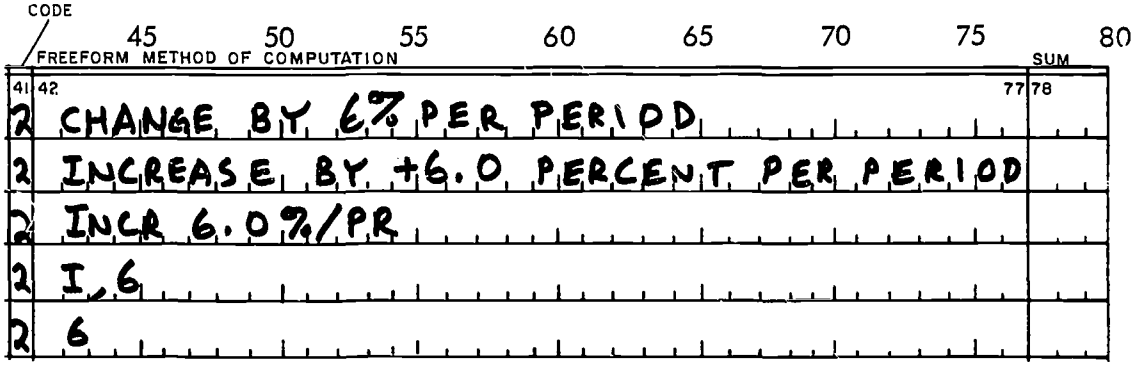


Figure 6

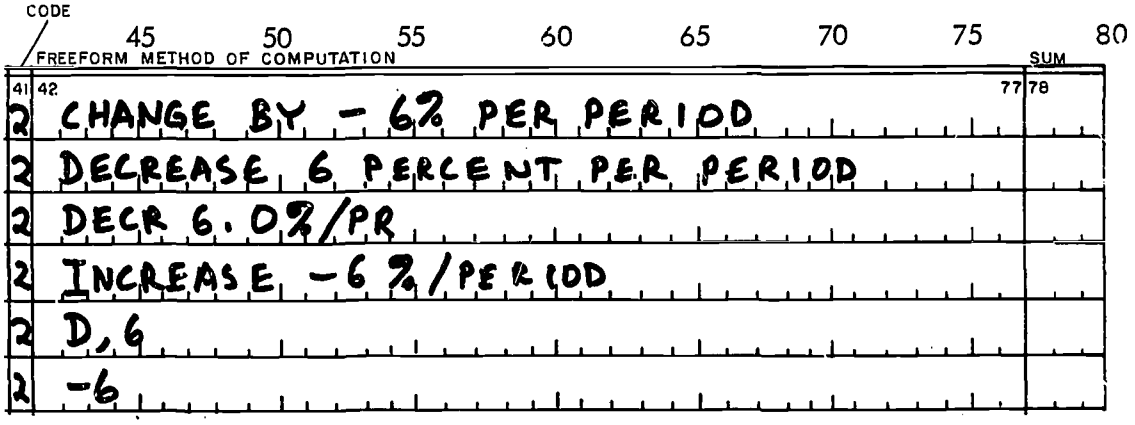
Independent Variables

As noted in the previous chapter, there are four basic techniques for projecting independent variables: change by a percentage, change by an incremental amount, change to a goal value in a specified number of periods, and insert constant values into planning periods.

Change by a percentage. To change the variable by a specified percentage each period, a value must be present in the BASE LEVEL field, and the CODE field must contain a "2." Depending upon the degree of model documentation desired, the planner may use any one of a variety of terms in the METHOD field to generate the projection. For example, any of the following terms* would increase the base level by 6 percent per period:



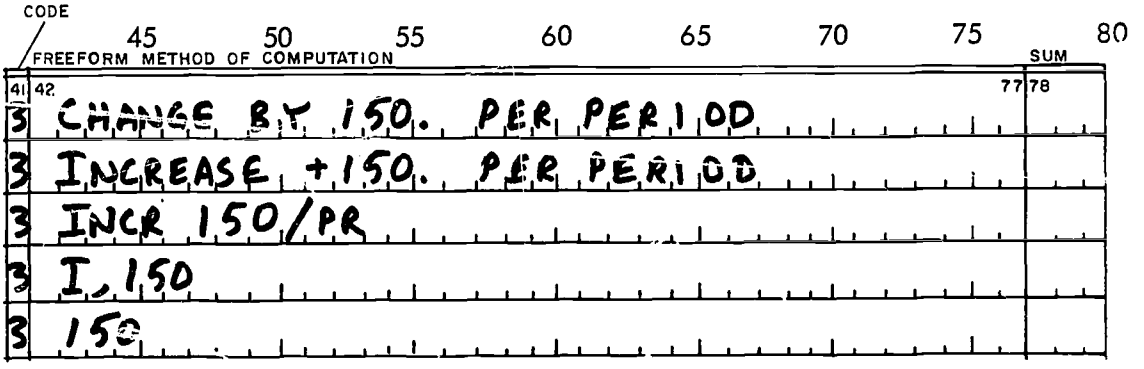
To specify a 6 percent reduction from the base level, any of the following may be used:



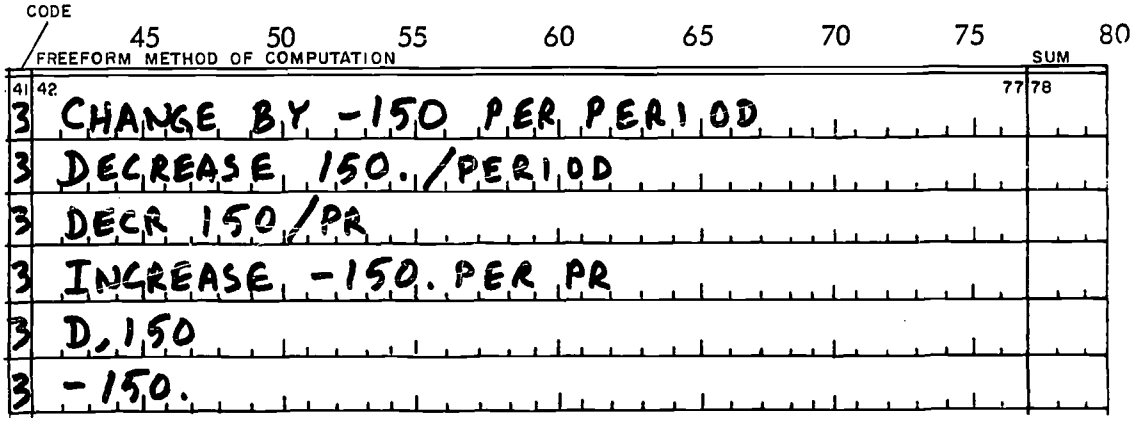
* The PLANTRAN language is designed to adapt to an increasing level of competence of users. Thus, as modelers become more proficient they may wish to eliminate some of the verbosity, writing instructions in a more cryptic, yet shorter, format. The examples shown on this and following pages each demonstrate the capability to increasingly shorten the instructions. The consequence--an increasingly cryptic instruction--is also demonstrated.

Note that this instruction produces a compounded percentage change--the value of each period is the given percentage above (or below) the value of the previous period. If the code "2" is used, and the METHOD field is left blank, zero percent is assumed, and the value for the base level will be inserted in each period of the planning horizon. The character "D," standing for decrease, is reserved, and should not be used unless a decrease is desired.

Change by an incremental amount. The second instruction changes the variable by a specified, fixed amount. This type of projection also requires a value in the BASE LEVEL field. The numeral "3" must be present in the CODE field. The examples below show the variety of terms the planner may use to increase the base level to be increased by 150 per period:



For a reduction of 150 per period along the planning horizon, any of these terms could be used:



This instruction produces a variable consisting of period values that are the incremental amount above (or below) the values of the previous period. If the METHOD field is left blank, the increment is assumed to be

ERIC

zero and the value that has been entered in the base level field will be inserted in each planning period. The character "D" is reserved, and should not be used unless a decrease is desired.

Change to a goal value in a specified number of periods. A planner can use this instruction to insert a goal value and to specify the planning period in which the goal is to be reached. The variable is generated by calculating the difference between the base level field and the goal level, and equally distributing that difference either by adding it to, or subtracting it from, each intervening period up to the specified goal period. If the goal value is specified for a period earlier than the last in the planning horizon, the goal value will be retained for the remaining periods. The numeral "4" must be present in the CODE field. The following terms show how this instruction can be reflected in the METHOD field to cause, for example, an increase to 1500 in the fifth period of the planning horizon:

CODE	FREEFORM METHOD OF COMPUTATION (45 50 55 60 65 70 75 80)	SUM
41 42		77 78
4	CHANGE TO 1500 IN P 5 PERIOD	
4	INCREASE TO +1500 IN P 5	
4	INCREASE 1500 P 5	
4	I, 1500 P 5	
4	1500 P 5	

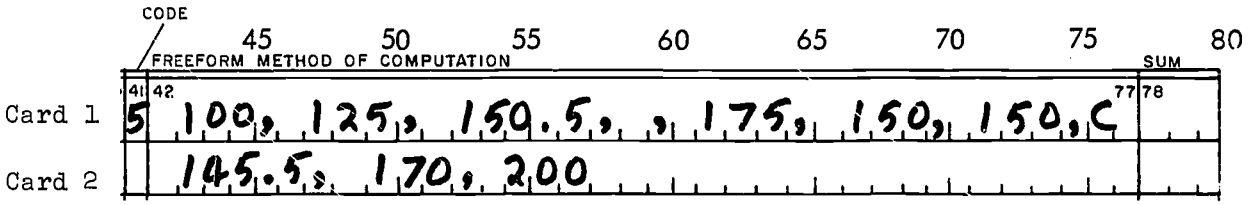
Note that the period in which the goal is to be achieved must be preceded by the letter "P," a reserved character.

Insert constant values into planning periods. This instruction allows the planner to insert values into any or all of the planning periods. For this instruction, a comma (,) is used as the delimiter to separate planning periods. If more than the 36 columns of the METHOD field are required to contain the data, the letter "C" must be used to continue the data on the method field of a following card. The use of this instruction requires the numeral "5" to be present in the CODE field. If a planning period is to be skipped (set to zero), the comma delimiter follows blank columns, or immediately follows the preceding comma.

As an example of how constant values can be inserted into planning periods, the numbers below show planning periods and values for each period.

Planning Period:	1	2	3	4	5	6	7	8	9	10
Values:	100	125	150.5	0	175	150	150	145.5	170	200

These data would require two cards. On the first card all of the data fields would be used. On the second card only the METHOD field would have to be used. The example below shows how the CODE and METHOD field would appear on the two cards:



Since commas are used as delimiters, they cannot be used to separate thousands or millions. In other words, if a number of four or more digits is entered it must be written without commas: 10932 not 10,932. The character "C" is reserved. Finally, the value to be inserted in an individual planning period has a maximum of eight digits, plus a sign, plus a decimal point.

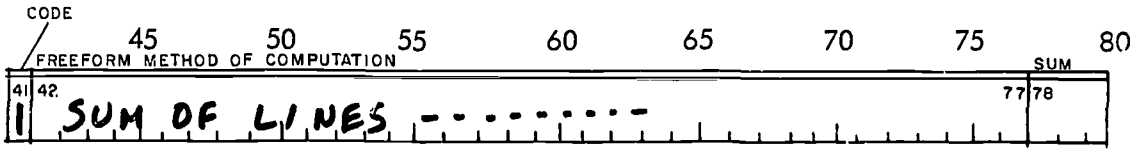
Dependent Variables

Instructions for handling dependent variables are the most powerful of all the instructions in the planning system. It is this capacity to interrelate lines in an almost unlimited fashion that permits the construction of a model that represents an organization. There are five basic instructions for handling dependent variables: summary of other lines, function of other variables, maximum or minimum of other variables, accumulative sum (or product) of other variables, and constant value times last period value of another variable.

Summary of other lines. This instruction permits any number of other variables, regardless of how they were derived, to be summarized. The summarized line can even be included in another summary line, as long as there is the capability for generating sub-subtotals, subtotals, and final totals. There is no limit to the number of variables that can be included in a summary variable. To indicate a summary variable, the numeral "1" must be present in the CODE field. The METHOD field is not used in processing the variable. However, it may be used for comments to aid the

ERIC

planner in documenting his model. Line numbers of the variables included in the summary variable may be shown in the method field. The lines to be included in the summary must contain the line number of the summary line in their SUM field.



Function of other variables. This instruction permits the use of up to four other variables, constant values, or constant values times variables in combinations of addition subtraction, division, and multiplication.

In using this instruction, the numeral "6" must be entered in the code field. Other symbols and terms that are used in the instruction and their meanings are:

( ) indicates the arithmetic operation desired in the calculation.

\+ indicates addition.

\- indicates subtraction.

/ indicates division.

* indicates multiplication.

C indicates that the function is continued on the method field of the next card. This is a reserved character.

Line number is any line number inserted by the planner. Use of a line number is optional, but if one is used, it must be preceded by the character "L," which is reserved.

Constant value is any real or integer value inserted by the planner. Use of this value is optional and the value is assumed to be 1.0 if left blank.

The function desired for the variable is expressed in the method field as:

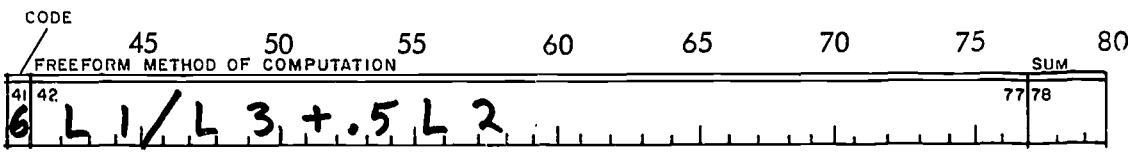
Constant Value$_1$ times Line Number$_1$ (+ - / *) Constant Value$_2$ times Line Number$_2$ (+ - / *)

Constant Value$_3$ times Line Number$_3$ (+ - / *) Constant Value$_4$ times Line Number$_4$.

The following lines provide an example of this instruction:

	Period	1	2	3	4	5	6	7	8	9	10
Line	No. 1	100	110	120	130	140	150	160	170	180	190
Line	No. 2	10	20	30	40	50	60	70	70	70	70
Line	No. 3	2	2	2	2	3	3	3	3	4	4

In the METHOD field the following term is specified:



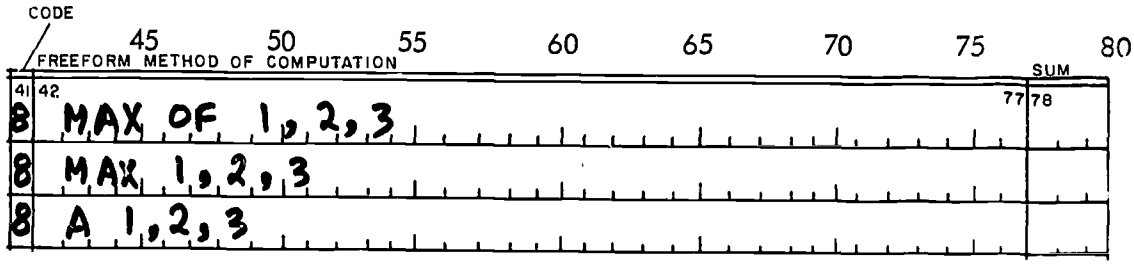
This example means that line number 1 is to be divided by line number 3 plus 0.5 times number 2. The result of the above calculation is:

Period	1	2	3	4	5	6	7	8	9	10
Result	55.0	65.0	75.0	85.0	71.6	80.0	88.3	91.6	80.0	82.5

Maximum or minimum of other variables. This instruction is used to examine up to four other variables to identify a variable that is either the maximum or the minimum value in each separate planning period contained within the variables being examined. The numeral "8" must be entered in the CODE field. At least two variables must be specified in the METHOD field, following an indicator to reflect maximum or minimum. The following examples show these variables and the terms used to obtain both the maximum and minimum variables.

	Period	1	2	3	4	5	6	7	8	9	10
Line	No. 1	10	20	30	40	50	60	70	70	70	70
Line	No. 2	2	4	8	16	32	64	128	156	156	156
Line	No. 3	70	60	50	20	20	20	20	20	20	20

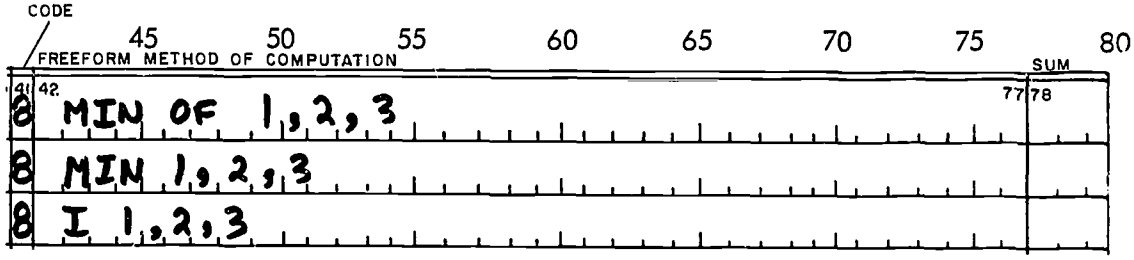
First, to obtain the maximum, the following terms could be used in the METHOD field:



The result of any of these terms would be:

Period	1	2	3	4	5	6	7	8	9	10
Result	70	60	50	40	50	64	128	156	156	156

To obtain the minimum of the same three variables, the following terms could be used:



The result would be:

Period	1	2	3	4	5	6	7	8	9	10
Result	2	4	8	16	20	20	20	20	20	20

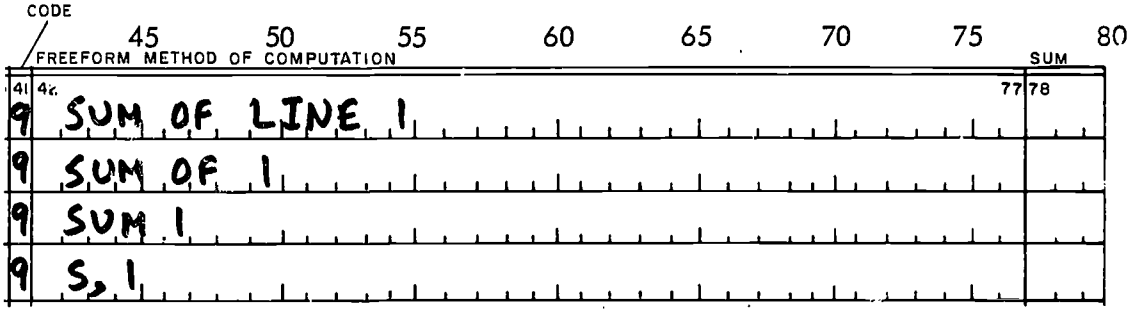
Note that the variables to be examined for maximum or minimum are separated within the term by the comma delimiter. Note that the characters "A" and "I" are both reserved, with "A" standing for maximum and "I" standing for minimum.

Accumulative sum, or product, of another variable. This instruction produces an accumulative summation of a variable, period by period across the entire planning horizon. The first period value is added to the second period variable, which is then added to the third period variable, and so on. It also provides for the accumulative product of period values of a variable in which each value is multiplied by the value of the preceding period. The use of the BASE LEVEL field is optional. The CODE

field must contain the numeral "9." To provide an example of both uses of this instruction, we will use the following variables:

Period	1	2	3	4	5	6	7	8	9	10
Line No. 1	1	2	3	4	2	1	1	1	0	2

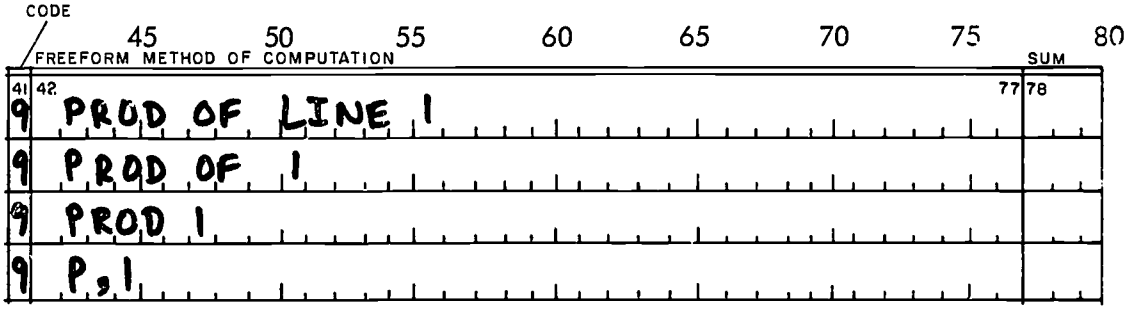
To generate the accumulative sum, one of the following terms could be used in the METHOD field:



The result of any of the above terms would be:

Period	1	2	3	4	5	6	7	8	9	10
Result	1	3	6	10	12	13	14	15	15	17

To generate the accumulative product, any of the following terms could be used:



The result of any of the above terms would be:

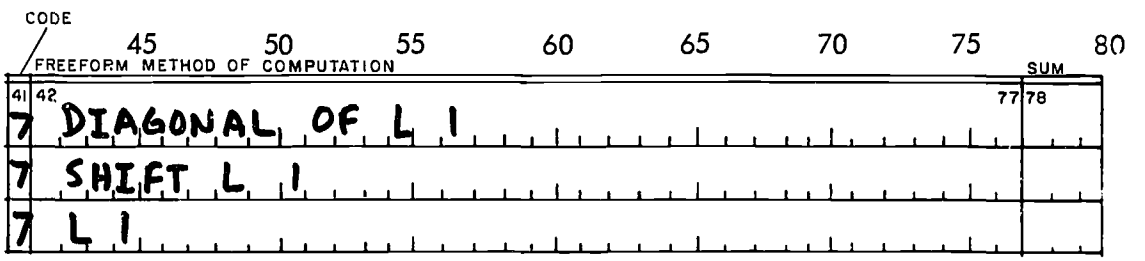
Period	1	2	3	4	5	6	7	8	9	10
Result	1	2	6	24	48	48	48	48	0	0

When using the accumulative product option, if a period of the variable being accumulated contains a zero, that period and all following periods of the accumulative product variable will contain a zero. The characters "S" and "P" are both reserved, with "S" standing for summary, and "P" standing for product.

Constant value times last period's value of another variable. This instruction permits a variable to be shifted one period to the right, as when taking a constant value times the variable and moving it one period toward the planning horizon. Use of the instruction requires that a value be present in the BASE LEVEL field of the variable being shifted, or zero will be used. The BASE LEVEL is optional in the result variable. The CODE field must contain the numeral "7" in the result variable. If a constant value times the variable being shifted is desired, it must be shown in the term. If no constant factor is given, 1 is assumed. For an example of both uses of this instruction we will use the following variables:

Base level	Period									
100	1	2	3	4	5	6	7	8	9	10
Line No. 1	110	120	130	140	150	160	170	180	190	200

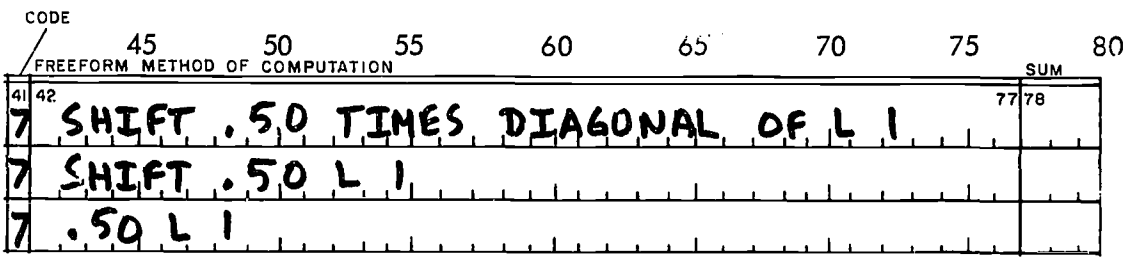
To shift the exact values of the above variable, any of the following terms could be used in the method field:



The result of any of the above terms would be:

Period	1	2	3	4	5	6	7	8	9	10
	100	110	120	130	140	150	160	170	180	190

To shift the variable times a constant value, one of the following terms could be used:



The result of any of the above terms would be:

Period	1	2	3	4	5	6	7	8	9	10
	50	55	60	65	70	75	80	85	90	95

Note that in either option, the line number of the variable being shifted is preceded by the character "L". This character is required and is a reserved character.

The above description completes the instructions for the dependent variables. There is one more instruction in the PLANTRAN language set. It provides for the division of sections of the model, and inserting of comments, by the use of headings.

Headings

The final type of instruction input in the PLANTRAN language concerns the use of headings. The use of headings permits the model to be divided into sections and the insertion of explanatory and other comments.

To include a heading or comment in the model printout, the LINE NUMBER and PLANNING ITEM fields are used. The LINE NUMBER field is required, just as in any other instruction. The heading or comment is placed in the PLANNING ITEM field. The CODE field must be left blank. The absence of characters in the CODE field causes the data that have been entered in the PLANNING ITEM field to be printed to the left of other planning item information in the analysis of planning matrix, and in the center of the summary report output.

SUMMARY REPORT INPUT

The third type input format for PLANTRAN is the summary report input. This input permits the planner to title and specify the content of summary reports. The format that is used for this input is shown in Figure 7. The data fields on the summary report input sheet are:

Field 1--Columns 1-24, TITLE. This space is for the title that is to appear on the report.

Field 2--Columns 25-79, FREEFORM REPORT LINES. This space should contain the line numbers of the planning items, or variables, that are to be included in the summary report.

SUMMARY REPORT DATA SHEET

Name _____

Project _____

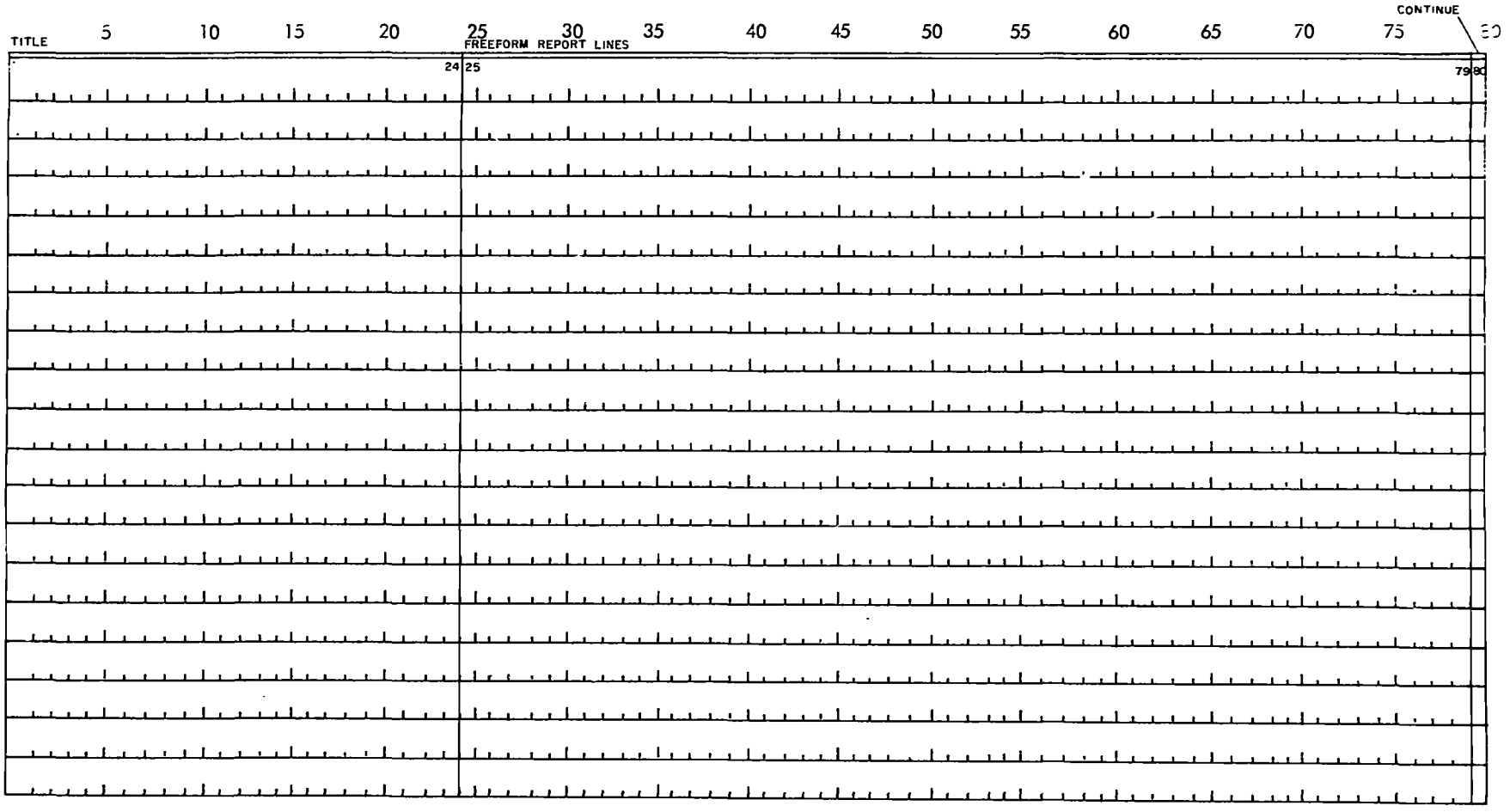


Figure 7

Field 3--Column 80, CONTINUE. This field indicates the presence of additional cards (or additional lines) that are to be included in the report. Specification of what a summary report is to be called and what it is to contain is accommodated within the format of this card. This specification may extend to two or more cards.

The TITLE field allows the planner to give a unique name to the report that will logically identify the content of the report. Up to 24 columns of data are permitted in this field.

The FREEFORM REPORT LINES field is used to specify the variables or planning items to be included in the report. Variables may be uniquely identified by specifying the actual line number, or they may be included in a sequence of line numbers. Individual line numbers are separated by commas (,). Sequences are denoted by specifying the first line number in the sequence, followed by a dash or hyphen, and then the last line number in the sequence. To continue the report lines field to another card, the character C should be inserted in the CONTINUE field. There is no limit to the number of times a line number may be specified, nor is there any limit to the number of cards to be used in specifying a summary report. Blanks may be present in the report lines field. For an example, Figure 8 shows the input format required to create a summary report titled Financial Report, and containing line numbers 1, 3, 5 through 11, 14, 16 through 22, 27, 29, 31, 30, 46, 48, 50 through 61, 70 through 82, 85, 87, 91, and 100 The lines will appear on the summary report in the sequences indicated above. For additional summary reports having a different title and other line number content, the above process is repeated on another line of the summary report data sheet.

This chapter has described the basic elements of PLANTRAN. The next chapter discusses the design of a planning model, using the various kinds of instructions in the modeling language.

ERIC

SUMMARY REPORT DATA SHEET

Name _____

Project _____

TITLE (1–24)	FREEFORM REPORT LINES (25–79)	CONTINUE (80)
FINANCIAL REPORT	1,3,5-11,14,16-22,27,29,31,30,46,48,50-61,70-82,85,	C
	87,91,100	

Figure 8

CHAPTER V

EXAMPLES OF MODEL DESIGN

At this point, we are ready to use the modeling language to structure specific information relating to an organization. This structuring process will build the planning model. In developing the model, there are several important considerations:

1. Data about the detailed characteristics of the organization must be available.

2. The known and assumed facts that influence the operation of the organization through time should have quantifiable interrelationships.

3. The ability to assess accurately the overall relationships among components of the organization is less reliable than the knowledge of the individual components.

4. Construction of a model and observation of the interaction of the factors contained within it provide greater understanding of the operation of the organization.

5. The results do not have to be perfect to be helpful.

As the planner begins to construct the model, he should keep these considerations in mind. Of course, in actually designing the model, a systematic approach is important. The following guide, "Steps in Model Design," is one way to approach the model building task.

Steps in Model Design

1. Specify the planning objectives: The choice of significant objectives depends on the planner's knowledge of his organization and on his ability to relate that knowledge to causes and effects. The final value to be derived from the model can be enhanced by the clarity of those objectives or goals.

2. Relate boundaries to the objectives: There are limits to the objectives, and these should be determined or at least taken into account if a realistic model is to be constructed.

3. Identify items to be contained within the model: These items, or variables, must be the elements of which the organization is comprised. They must be identified at a level of detail to accommodate the model objectives.

4. Determine relationships between interconnected elements: The interacting items, or dependent variables, must reflect the relationship of the interconnected elements of the organization. This must be done in a manner that permits examination of the effects of the variables under study.

5. Set item values at realistic levels: The values of the variable must be set at levels that are valid, or if not known, are at least within reason.

In designing a model, the normal procedure is to build upward from available knowledge about the individual planning items. In some cases, it may be desirable, or even necessary, to construct a variable by working backward from the known results. The following two examples demonstrate the flexibility of the modeling language in relation to these two design approaches and show how elements of planning information may be obtained.

The first example, illustrated in Figures 9, 10, and 11, consists of determining two result variables--one for Line 12, Fees/Student, and the other for Line 13, Endowment, Gift, and Grant Income. These elements are being examined at this particular run.

Figure 9 shows the line number, the planning item, the base level (where applicable), and the method of computation used to generate the variable. Figure 10 shows the instruction data sheet input. Figure 11 shows the model program output for each variable through the entire planning horizon. Note that in this model the given elements, or independent variables of Faculty, Student-Faculty Ratio, Average Faculty Compensation, Departmental Expense, Administration and General Expense, and Percent G & E from Fees were used to derive, through interline relationships, all the remaining dependent variables. The interline relationships remain the same for these dependent variables across the planning horizon. The values differ due to changes in the independent variables.

The second example, shown in Figures 12, 13, and 14, determines four result variables--Total Fee, Income, Faculty, Total Faculty Compensation and Total Department Expense. Note that Fees/Student, which was a dependent or result variable in the first example, is an independent variable in this example. Figure 12 shows the line number, the planning item, the base level, and the method of computation. Figure 13 shows the instruction data sheet input. Figure 14 shows the results of the model.

LINE NO.	ITEM	BASE	METHOD OF COMPUTATION
1	FACULTY	30.	INCREASE BY 2. PER YEAR.
2	STUDENT-FACULTY RATIO	25.5	DECREASE BY .5 PER YEAR.
3	STUDENTS		L.. E 1 TIMES LINE 2.
4	AVERAGE FACULTY COMPENSATION	10500.	INCREASE BY 2% PER YEAR.
5	DEPARTMENT EXPENSE	14500.	INCREASE BY 250. PER YEAR.
6	INSTRUCTION EXPENSE		LINE 1 TIMES LINE 4 PLUS LINE 5.
7	ADMIN. AND GEN. EXPENSE	315000.	INCREASE BY 20000. PER YEAR.
8	TOTAL G AND E EXPENSE		LINE 6 PLUS LINE 7 DIVIDED BY .94.
9	LIBRARY		LINE 8 TIMES .06.
10	PERCENT G AND E FROM FEES	58.	INCREASE BY 1.5 PER YEAR.
11	TOTAL FEE INCOME		.01 TIMES LINE 8 TIMES LINE 10.
12	FEES/STUDENT		LINE 11 DIVIDED BY LINE 3.
13	ENDOWMENT GIFT AND GRANT		LINE 8 MINUS LINE 11.

Figure 9

INSTRUCTION DATA SHEET

MRI

Name

Project MODEL DESIGN EXAMPLE 1

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
1 3	4	5 32	33 40	41	42 77	78
1		FACULTY	30.	3	INCREASE BY 2. PER YEAR	
2		STUDENT-FACULTY RATIO	25.5	3	DECREASE BY .5 PER YEAR	
3		STUDENTS		6	L1 * L2	
4		AVERAGE FACULTY COMPENSATION	10500.	2	INCREASE BY 2% PER YEAR	
5		DEPARTMENT EXPENSE	14500.	3	INCREASE BY 250. PER YEAR	
6		INSTRUCTION EXPENSE		6	L1 * L4 + L5	
7		ADMIN AND GEN EXPENSE	315000.	3	INCREASE BY 20000. PER YEAR	
8		TOTAL G AND E EXPENSE		6	L6 + L7 / .94	
9		LIBRARY		6	L8 * .06	
10		PERCENT G AND E FROM FEES	48.	3	INCREASE BY 1.5 PER YEAR	
11		TOTAL FEE INCOME		6	.01 L8 * L10	
12		FEES / STUDENT		6	L11 / L3	
13		ENDOWMENT GIFT AND GRANT		6	L8 - L11	

Figure 10

SUMMARY REPORT OVERVIEW MODEL FXAMPLE
MODEL DESIGN EXAMPLE 1

JAN. 14,1971

	PLANNING ITEM	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR10
1	FACULTY	32.0	34.0	36.0	38.0	40.0	42.0	44.0	46.0	48.0	50.0
2	STUDENT-FACULTY RATIO	25.0	24.5	24.0	23.5	23.0	22.5	22.0	21.5	21.0	20.5
3	STUDENTS	800	833	864	893	920	945	968	989	1008	1025
4	AVERAGE FACULTY COMPENSATION	10919	11356	11811	12283	12774	13285	13817	14369	14944	15542
5	DEPARTMENTAL EXPENSE	14750	15000	15250	15500	15750	16000	16250	16500	16750	17000
6	INSTRUCTION EXPENSE	364189	401131	440448	482273	526744	574005	624210	677518	734099	794128
7	ADMIN AND GEN EXPENSE	335000	355000	375000	395000	415000	435000	455000	475000	495000	515000
8	TOTAL G AND E EXPENSE	743819	804394	867498	933269	1001855	1073410	1148096	1226083	1307552	1392689
9	LIBRARY	44629	48263	52049	55996	60111	64404	68885	73565	78453	83561
10	PERCENT G AND E FROM FEES	49.5	51.0	52.5	54.0	55.5	57.0	58.5	60.0	61.5	63.0
11	TOTAL FEE INCOME	368190	410241	455436	503965	556029	611843	671636	735650	804144	877394
12	FEES / STUDENT	460.2	492.5	527.1	564.4	604.4	647.5	693.8	743.8	797.8	856.0
13	ENDOWMENT GIFT AND GRANT	375628	394153	412061	429304	445825	461566	476459	490433	503497	515295

Figure 11

LINE NO.	ITEM	BASE	METHOD OF COMPUTATION
1	STUDENTS	800.	INCREASE BY 3% PER YEAR.
2	FEES/STUDENT	550.	INCREASE BY 7% PER YEAR.
3	TOTAL FEE INCOME	--	LINE 1 TIMES LINE 2.
4	STUDENT-FACULTY RATIO	23.	CHANGE TO 18. IN 5 YEARS.
5	FACULTY	--	LINE 1 DIVIDED BY LINE 4.
6	AVERAGE FACULTY COMPENSATION	10500.	INCREASE BY 4% PER YEAR.
7	TOTAL FACULTY COMPENSATION		LINE 5 TIMES LINE 6.
8	DEPARTMENT EXPENSE/FACULTY	500.	INCREASE BY 3% PER YEAR.
9	TOTAL DEPARTMENT EXPENSE		LINE 5 TIMES LINE 8.
10	ADMIN. AND GEN. EXPENSE	315000.	INCREASE BY 20000. PER YEAR.
11	LIBRARY AS PERCENT G AND E	5.	INSERT 5. IN YEARS 1-3, 6. IN YEARS 4-7, 7. IN YEARS 8-10.
12	TOTAL G AND E EXPENSE		SUM OF LINES 7, 9, AND 10.
13	LIBRARY		.01 TIMES LINE 11 TIMES LINE 12.
14	NON-FEE INCOME		LINE 12 MINUS LINE 3.

Figure 12

INSTRUCTION DATA SHEET

MRI

Name

Project MODEL DESIGN EXAMPLE 2

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
1		STUDENTS	800.	2	INCREASE BY 3% PER YEAR	
2		FEES / STUDENT	550.	2	INCREASE BY 7% PER YEAR	
3		TOTAL FEE INCOME		6	L1 * L2	
4		STUDENT-FACULTY RATIO	23.	4	CHANGE TO 18. IN P5	
5		FACULTY		6	L1 / L4	
6		AVERAGE FACULTY COMPENSATION	10500.	2	INCREASE BY 4% PER YEAR	
7		TOTAL FACULTY COMPENSATION		6	L5 * L6	12
8		DEPARTMENT EXPENSE / FACULTY	500.	2	INCREASE BY 3% PER YEAR	
9		TOTAL DEPARTMENT EXPENSE		6	L5 * L8	12
10		ADMIN AND GEN EXPENSE	315000.	3	INCREASE BY 20000. PER YEAR	12
11		LIBRARY AS PERCENT G AND E	5.	5	5,5,5,6,6,6,6,7,7,7	
12		TOTAL G AND E EXPENSE		1	SUMMARY OF LINES 7, 9, AND 10	
13		LIBRARY		6	.01 L11 * L12	
14		NON-FEE INCOME		6	L12 - L3	

Figure 13

SUMMARY REPORT OVERVIEW MODEL EXAMPLE
MODEL DESIGN EXAMPLE 2

JAN. 14,1970

	PLANNING ITEM	BASE	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR10
1	STUDENTS	800	823	848	874	900	927	955	983	1013	1043	1075
2	FEES / STUDENT	550	588	629	673	720	771	825	883	945	1011	1081
3	TOTAL FEE INCOME	0	484923	534434	589000	649137	715414	788458	868959	957680	1055459	1163222
4	STUDENT-FACULTY RATIO	23.0	22.0	21.0	20.0	19.0	18.0	18.0	18.0	18.0	18.0	18.0
5	FACULTY	-0.0	37.5	40.4	43.7	47.4	51.5	53.1	54.7	56.3	58.0	59.7
6	AVERAGE FACULTY COMPENSATION	10500	10919	11356	11811	12283	12774	13285	13817	14369	14944	15542
7	TOTAL FACULTY COMPENSATION	0	409003	458987	516251	582113	658202	705066	755267	809042	866646	928351
8	DEPARTMENT EXPENSE/FACULTY	500.0	515.0	530.4	546.4	562.8	579.6	597.0	614.9	633.4	652.4	672.0
9	TOTAL DEPARTMENT EXPENSE	0	19289	21438	23881	26668	29864	31683	33613	35660	37831	40135
10	ADMIN AND GEN EXPENSE	315000	335000	355000	375000	395000	415000	435000	455000	475000	495000	515000
11	LIBRARY AS PERCENT G AND E	5.0	5.0	5.0	5.0	6.0	6.0	6.0	6.0	7.0	7.0	7.0
12	TOTAL G AND E EXPENSE	0	763292	835426	915132	1003782	1103067	1171750	1243880	1319702	1399478	1483487
13	LIBRARY	0	38164	41771	45756	60226	66184	70305	74632	92379	97963	103944
14	NON-FEE INCOME	0	278368	300991	326131	354645	387653	383291	374920	362021	344018	320265

Figure 14

These two examples show that unknown, or effect, elements, can be derived from known, or cause, elements, whether the unknown elements are general or specific. What is required is that the relationships between elements are known and that they can be expressed in mathematical terms.

The above examples are rather simple and broad in scope in order to demonstrate the design concept from different points of view. The following example is one of a much more detailed model. The identification of the level of detail required is a crucial aspect in model design. This particular example concerns a faculty salary analysis.

Figure 15 shows the "outline of plans" worksheet associated with the example. The Planning Subject is divided into several categories of faculty quality and satisfaction. The one we will deal with is 1.1, Salary. The Long Range Program Goal is "to upgrade quality and satisfaction of professors by increasing the average compensation, changing the distribution of faculty by rank, and increasing the student-to-faculty ratio." The Problem Statement column contains information on the current status of factors relating to the goals; in the Long Range Program Goals column is similar information relating to where salaries should be in 5 years. The following is a breakout of the information.

1. Average Faculty Salary

Rank	Current Salary	5-Year Goal Salary
Professor	$11,500	$22,571
Associate	10,970	15,233
Assistant	10,090	14,076
Instructor	8,100	11,196

2. Distribution of Faculty by Rank

Rank	Current Percentage	5-Year Goal Percentage
Professor	35	20
Associate	25	30
Assistant	20	30
Instructor	20	20

3. Student-to-Faculty Ratio

Current Ratio	5-Year Goal Ratio
12:1	20:1

OUTLINE OF PLANS

☐ Worksheet
☐ Discussion Draft
☐ Proposed Draft
☐ Approved Plan

Name of Institution or Department

Plan Date | Replaces Plan Of | Next Review Date

1. Urgent Need
2. Important Need
3. Moderate Need
4. Minimal Need

Index of Need

Index of Difficulty
1. Not Difficult
2. Moderately Difficult
3. Highly Difficult
4. Very Highly Difficult

Planning Subject	Problem Statement	Long Range Program Goals	Plan Of Action	Resource Identification And Development Plans	▽	▽	Composite Priority	Organizations Concerned With Planning, Decisions and Action	Objectives And Milestones By Years
Faculty Quality & Satisfaction 1. Compensation 1.1 Salary	1. Current Average Faculty Salary Rank / AAUP / Salary Professor D $11,500 Associate C 10,970 Assistant B 10,090 Instructor B 8,100 2. Distribution of Faculty by Rank Professor 35% Associate 25% Assistant 20% Instructor 20% 3. Student Faculty Ratio 12:1 4. F.T.E. Student Enrollment Has Remained Constant During the Last 5 Years 5. Salary Distribution Professor 142% Associate 135% Assistant 124% Instructor 100%	To upgrade quality and satisfaction of professors by increasing the average compensation, changing the distribution of faculty by rank and increasing the student to faculty ratio. 1. Average Faculty Salary Rank / AAUP / Salary Professor B $22,571 Associate B 15,233 Assistant A 14,076 Instructor A 11,196 2. Distribution of Faculty by Rank Professor 20% Associate 30% Assistant 30% Instructor 20% 3. Student Faculty Ratio to 20:1. 4. Increase Student Body by 30 F.T.E. Students from Base 900. 5. Salary Distribution - "B" Scale Professor 220% Associate 157% Assistant 125% Instructor 100%	To change internal structure of college while maintaining the integrity of program curricula by obtaining real understanding and agreement from parties concerned. A. Obtain Authorization 1. Personnel committee and the Dean request planning officer to investigate means to increase average salaries. 2. Planning officer examines trade-offs among alternative expenditures, including increased salaries, prepares report to faculty body. 3. Faculty body and student representatives review planning officer's report; they set up Ad Hoc Committees to do field work which includes visits to colleges with similar problems and motives, meet with AAUP representatives. Ad Hoc Committee prepares report to faculty body and student senate. 4. Faculty body and student senate meet to review, revise and approve report. 5. Academic Affairs Committee meet to review, revise and approve recommended plan. 6. Board of Trustees meet to review, revise, and approve recommended plan. B. Implementation 7. Alumni groups more actively assist in the identification, selection and recruitment of new students. 8. Change the nature of faculty recruitment, hire fewer faculty, but better quality by recruiting more actively and advertise more openly. C. Follow-up 9. Monitor progress toward satisfaction of long-range goals, if progress is substantially different either revise strategy or long-range goals.	Dean of College Personnel Committee Planning Officer Faculty Senate Faculty Body Student Senate Chapter AAUP Representatives Academic Affairs Committee Board of Trustees State Board of Regents State Legislature Alumni Groups General Community Leaders				Dean of College Personnel Committee Planning Officer Faculty Senate Faculty Body Student Senate Academic Affairs Committee Board of Trustees State Board of Regents State Legislature Alumni Groups	See Computer Printout of the Faculty Salary Planning Model
1.2 Fringe Benefits 1.3 Total Compensation 1.4 Future Salary Prospects 2. Job Related Factors 2.1 Courses Taught 2.2 Teaching Load 2.3 Research Facilities & Opportunities 2.4 Competency of Colleagues 2.5 Reputation of School 2.6 Quality of Students 2.7 Nature of Administration and administrators 3. Environmental Factors 3.1 Cultural Opportunities 3.2 Congeniality of Colleagues 3.3 Nearness to Graduate School 3.4 Climate 3.5 Moonlighting Opportunities									

Figure 15

4. FTE Student Enrollment

Current Status	5-Year Goal Status
Constant at 800	Increase 30 per year from 800

5. Salary Distribution by Rank

Rank	Current Percentage	5-Year Goal Percentage
Professor	142	220
Associate	135	157
Assistant	124	125
Instructor	100	100

It is quickly apparent that these variables have significant relationships, and that to analyze individually each of the alternatives concerning the variables would be tedious and time consuming.

Conversion of this salary analysis and related data to the format of the planning language provides the basis for analysis of the effects of varying distributions of faculty by rank, distributions of salaries by rank, and average salaries--all within the framework of changes in the FTE enrollment and student-to-faculty ratio variables.

Conversion of the information to the planning language is rather simple. Figure 16 shows the line number, base data, and method of computation required for the task. Figures 17 and 18 show the instruction data sheet input to be used to generate the model. Figures 19 and 20 show the summary report output.

Once the model output is obtained, the planner, by examination and evaluation, determines which variables he wants to alter. This process of "exercising the model," noting the various effects on a check line, such as total faculty salaries, provides a basis for determining the most realistic course of action to follow. This type of planning information, for instance, can be helpful to colleges that want to achieve higher AAUP ratings, since importance is placed not only on raising overall average salaries, but also on adjusting the distribution of salaries among the ranks.

The end products of the model program, the reports, are designed for maximum flexibility--again the planner designs his own reports and may even change the format of the report for each run. The information contained in any line of the planning model can be printed any number of times, and

ERIC

LINE NO.	ITEM	BASE	METHOD OF COMPUTATION
1	AVERAGE FACULTY SALARY	--	HEADING
2	PROFESSOR	11500.	CHANGE TO 22571. IN 5 YEARS.
3	ASSOCIATE	10970.	CHANGE TO 15233. IN 5 YEARS.
4	ASSISTANT	10090.	CHANGE TO 14076. IN 5 YEARS.
5	INSTRUCTOR	8100.	CHANGE TO 11196. IN 5 YEARS.
6			
7	DISTRIBUTION OF FACULTY RANK	--	HEADING
8	PROFESSOR	35.	CHANGE TO 20. IN 5 YEARS.
9	ASSOCIATE	25.	CHANGE TO 30. IN 5 YEARS.
10	ASSISTANT	20.	CHANGE TO 30. IN 5 YEARS.
11	INSTRUCTOR	20.	NO CHANGE
12			
13	STUDENT FACULTY RATIO	12.	INCREASE BY 1.6 PER YEAR.
14	FTE STUDENT ENROLLMENT	800.	INCREASE BY 30. PER YEAR.
15			
16	TOTAL NUMBER OF FTE FACULTY	66.6	LINE 14 DIVIDED BY LINE 13.
17	NUMBER PROFESSORS	23.3	.01 TIMES LINE 16 TIMES LINE 8.
18	NUMBER ASSOCIATES	16.6	.01 TIMES LINE 16 TIMES LINE 9.
19	NUMBER ASSISTANTS	13.3	.01 TIMES LINE 16 TIMES LINE 10.
20	NUMBER INSTRUCTORS	13.3	LINE 16 MINUS LINE 17 MINUS LINE 18 MINUS LINE 19.
21			
22	TOTAL FACULTY SALARY	691979.	SUM OF LINES 23, 24, 25, 26.
23	TOTAL PROFESSORS SALARY	267950.	LINE 17 TIMES LINE 2, SUM ON 22.
24	TOTAL ASSOCIATES SALARY	182102.	LINE 18 TIMES LINE 3, SUM ON 22.
25	TOTAL ASSISTANTS SALARY	134197.	LINE 19 TIMES LINE 4, SUM ON 22.
26	TOTAL INSTRUCTORS SALARY	107730	LINE 20 TIMES LINE 5, SUM ON 22.
27	AVERAGE FACULTY SALARY	10400.	LINE 22 DIVIDED BY LINE 16.
28	DISTRIBUTION OF SALARY - RANK		HEADING
29	PROFESSOR	142.0	100. TIMES LINE 2 DIVIDED BY LINE 5.
30	ASSOCIATE	135.0	100. TIMES LINE 3 DIVIDED BY LINE 5.
31	ASSISTANT	124.0	100. TIMES LINE 4 DIVIDED BY LINE 5.
32	INSTRUCTOR	100.0	100. TIMES LINE 5 DIVIDED BY LINE 5.

Figure 16

INSTRUCTION DATA SHEET

MRI

Name _____

Project _____

LINE NO.	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
1		AVG FACULTY SALARY				
2		PROFESSOR	11500.	4	CHANGE TO 22571. IN P5 YEARS	
3		ASSOCIATE	10970.	4	CHANGE TO 15233. IN P5 YEARS	
4		ASSISTANT	10090.	4	CHANGE TO 14076. IN P5 YEARS	
5		INSTRUCTOR	8100.	4	CHANGE TO 11196. IN P5 YEARS	
6						
7		DISTRIBUTION OF FACULTY-RANK				
8		PROFESSOR	35.	4	CHANGE TO 20. IN P5 YEARS	
9		ASSOCIATE	25.	4	CHANGE TO 30. IN P5 YEARS	
10		ASSISTANT	20.	4	CHANGE TO 30. IN P5 YEARS	
11		INSTRUCTOR	20.	3		
12						
13		STUDENT FACULTY RATIO	12.	3	INCREASE BY .6 PER YEAR	
14		FTE STUDENT ENROLLMENT	800.	3	INCREASE BY 30. PER YEAR	
15						
16		TOTAL NUMBER OF FTE FACULTY	66.6	6	L14 / L13	
17		NUMBER PROFESSORS	23.3	6	.01 L16 * L8	
18		NUMBER ASSOCIATES	16.6	6	.01 L16 * L9	
19		NUMBER ASSISTANTS	13.3	6	.01 L16 * L10	

Figure 17

INSTRUCTION DATA SHEET

MRI

Name _____

Project _____

LINE NO.	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
20		NUMBER INSTRUCTORS	13.3	6	L16 - L17 - L18 - L19	
21						
22		TOTAL FACULTY SALARY	691979.	1	SUM OF LINES 23, 24, 25, 26	
23		TOTAL PROFESSORS SALARY	267950.	6	L17 * L2	22
24		TOTAL ASSOCIATES SALARY	182102.	6	L18 * L3	22
25		TOTAL ASSISTANTS SALARY	134197.	6	L19 * L4	22
26		TOTAL INSTRUCTORS SALARY	107730.	6	L20 * L5	22
27		AVERAGE FACULTY SALARY	10400.	6	L22 / L16	
28		DISTRIBUTION OF SALARY-RANK				
29		PROFESSOR	142.	6	100. L2 / L5	
30		ASSOCIATE	135.	6	100. L3 / L5	
31		ASSISTANT	124.	6	100. L4 / L5	
32		INSTRUCTOR	100.	6	100. L5 / L5	
33		SUMMARY				

Figure 18

FACULTY SALARY ANALYSIS REPORT — FACULTY SALARY ANALYSIS — SAMPLE COLLEGE - 1 — JANUARY 21 1970

	PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
	SUMMARY											
14	FTE STUDENT ENROLLMENT	800	830	860	890	920	950	980	1010	1040	1070	1100
16	TOTAL NUMBER OF FTE FACULTY	66.6	61.0	56.6	53.0	50.0	47.5	45.4	43.5	41.9	40.5	39.3
13	STUDENT FACULTY RATIO	12.0	13.6	15.2	16.8	18.4	20.0	21.6	23.2	24.8	26.4	28.0
	AVG FACULTY SALARY BY RANK											
2	PROFESSOR	11500	13714	15928	18142	20356	22571	22571	22571	22571	22571	22571
3	ASSOCIATE	10970	11822	12675	13527	14380	15233	15233	15233	15233	15233	15233
4	ASSISTANT	10090	10887	11684	1248.	13278	14076	14076	14076	14076	14076	14076
5	INSTRUCTOR	8100	8719	9338	9957	10576	11196	11196	11196	11196	11196	11196
	DISTRIBUTION OF FACULTY-RANK											
8	PROFESSOR	35.0	32.0	29.0	26.0	23.0	20.0	20.0	20.0	20.0	20.0	20.0
9	ASSOCIATE	25.0	26.0	27.0	28.0	29.0	30.0	30.0	30.0	30.0	30.0	30.0
10	ASSISTANT	20.0	22.0	24.0	26.0	28.0	30.0	30.0	30.0	30.0	30.0	30.0
11	INSTRUCTOR	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
16	TOTAL NUMBER OF FTE FACULTY	66.6	61.0	56.6	53.0	50.0	47.5	45.4	43.5	41.9	40.5	39.3
17	NUMBER PROFESSORS	23.3	19.5	16.4	13.8	11.5	9.5	9.1	8.7	8.4	8.1	7.9
18	NUMBER ASSOCIATES	16.6	15.9	15.3	14.8	14.5	14.3	13.6	13.1	12.6	12.2	11.8
19	NUMBER ASSISTANTS	13.3	13.4	13.6	13.8	14.0	14.3	13.6	13.1	12.6	12.2	11.8
20	NUMBER INSTRUCTORS	13.3	12.2	11.3	10.6	10.0	9.5	9.1	8.7	8.4	8.1	7.9

Figure 19

FACULTY SALARY ANALYSIS REPORT — FACULTY SALARY ANALYSIS — SAMPLE COLLEGE - I — JANUARY 21 1970

PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
22 TOTAL FACULTY SALARY	691979	708029	719315	727977	734290	738439	705332	676791	651933	630088	610739
23 TOTAL PROFESSORS SALARY	267950	267830	261351	249892	234103	214424	204810	196523	189305	182961	177343
24 TOTAL ASSOCIATES SALARY	182102	187596	193630	200662	208515	217070	207338	198948	191640	185219	179531
25 TOTAL ASSISTANTS SALARY	134197	146176	158661	171919	185903	200583	191590	183837	177085	171151	165895
26 TOTAL INSTRUCTORS SALARY	107730	106425	105671	105503	105767	106362	101593	97482	93901	90755	87968
27 AVERAGE FACULTY SALARY	10400	11601	12713	13741	14685	15546	15546	15546	15546	15546	15546
DISTRIBUTION OF SALARY-RANK											
29 PROFESSOR	142.0	157.3	170.6	182.2	192.5	201.6	201.6	201.6	201.6	201.6	201.6
30 ASSOCIATE	135.0	135.6	135.7	135.9	136.0	136.1	136.1	136.1	136.1	136.1	136.1
31 ASSISTANT	124.0	124.9	125.1	125.3	125.5	125.7	125.7	125.7	125.7	125.7	125.7
32 INSTRUCTOR	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Figure 20

in any sequence. This flexibility allows the planner to create reports in the format that is suitable both to his specific planning needs and to the overall needs of his institution.

To illustrate the technique for designing a report, we will use the information presented in the second example, shown in Figure 14. To generate the first report, we enter the report title, "STUDENTS," and then specify lines 1, 2, and 4. For the second report, we enter the title, "FACULTY," and specify lines 5 through 8. The third report is called "INCOME" and includes lines 3 and 14. The last report, "EXPENSES," consists of lines 7, 9, 10, 13, and 12. Figure 21 shows how this report design input should be entered on the Summary Report Data Sheet. This design would produce each report on a separate page. Figure 22, for ease of examination, shows all of the output on a single page.

The ease of report design and the almost unlimited flexibility provided by the system enable the planner to produce reports ranging from broad general summaries of the entire planning model to detailed analyses of specific elements of particular concern. Because the report design is flexible, the planner can adapt the format to the unique requirements of his organization and he can change the emphasis of the report at any time, thus giving the report maximum usefulness in planning for the future.

SUMMARY REPORT DATA SHEET

MRI

Name

Project REPORT DESIGN EXAMPLE

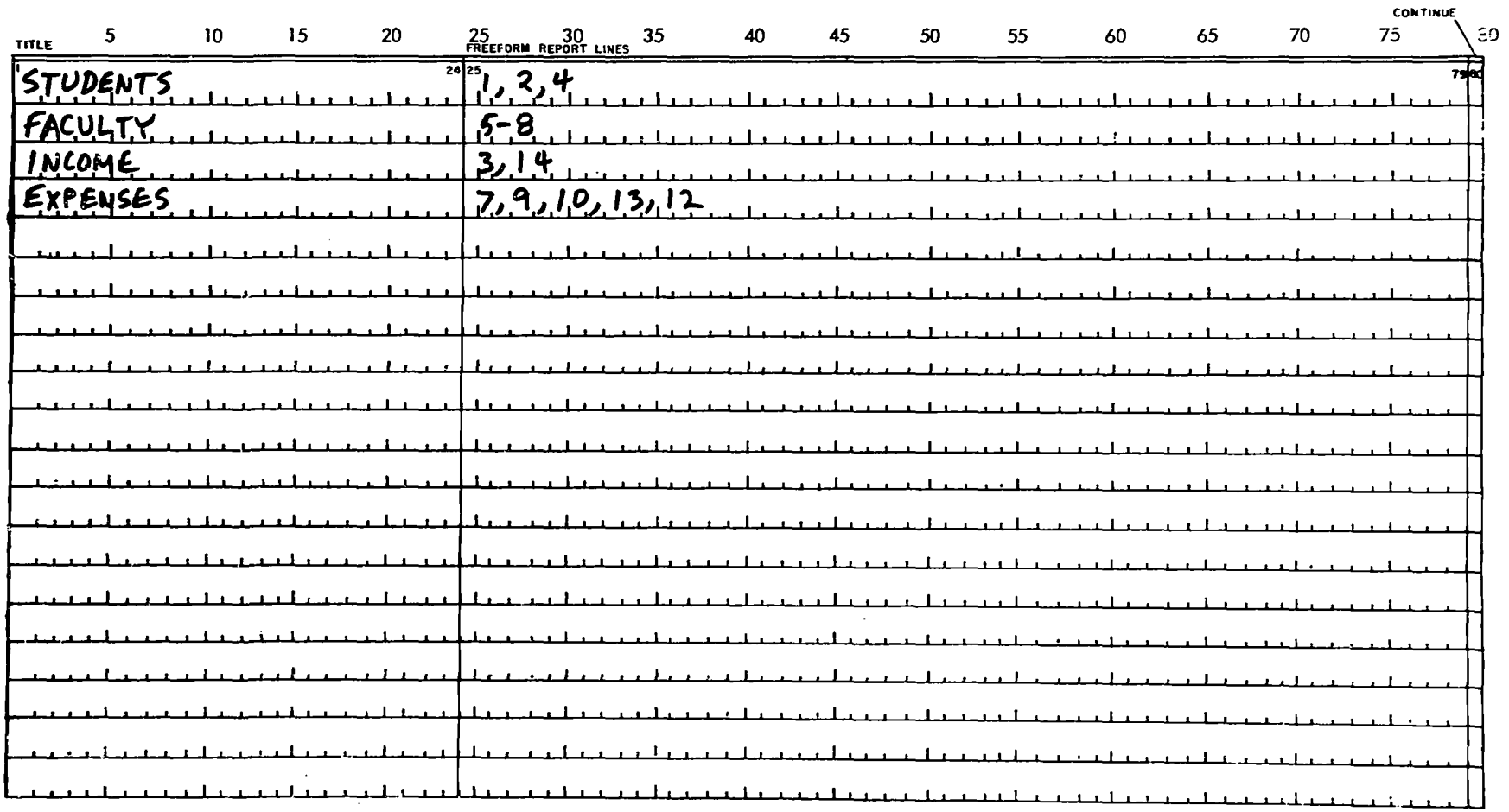


Figure 21

SUMMARY REPORT STUDENTS

	PLANNING ITEM	BASE	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR10
1	STUDENTS	800	823	848	874	900	927	955	983	1013	1043	1075
2	FEES / STUDENT	550	588	629	673	720	771	825	883	945	1011	1081
4	STUDENT-FACULTY RATIO	23.0	22.0	21.0	20.0	19.0	18.0	18.0	18.0	18.0	18.0	18.0

SUMMARY REPORT FACULTY

	PLANNING ITEM	BASE	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR10
5	FACULTY	-0.0	37.5	40.4	43.7	47.4	51.5	53.1	54.7	56.3	58.0	59.7
6	AVERAGE FACULTY COMPENSATION	10500	10919	11356	11811	12283	12774	13285	13817	14369	14944	15542
7	TOTAL FACULTY COMPENSATION	0	409003	458987	516251	582113	658202	705066	755267	809042	866646	928351
8	DEPARTMENT EXPENSE/FACULTY	500.0	515.0	530.4	546.4	562.8	579.6	597.0	614.9	633.4	652.4	672.0

SUMMARY REPORT INCOME

	PLANNING ITEM	BASE	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR10
3	TOTAL FEE INCOME	0	484923	534434	589000	649137	715414	788458	868959	957680	1055459	1163222
14	NON-FEE INCOME	0	278368	300991	326131	354645	387653	383291	374920	362021	344018	320265

SUMMARY REPORT EXPENSES

	PLANNING ITEM	BASE	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR10
7	TOTAL FACULTY COMPENSATION	0	409003	458987	516251	582113	658202	705066	755267	809042	866646	928351
9	TOTAL DEPARTMENT EXPENSE	0	19289	21438	23881	26668	29864	31683	33613	35660	37831	40135
10	ADMIN AND GEN EXPENSE	315000	335000	355000	375000	395000	415000	435000	455000	475000	495000	515000
13	LIBRARY	0	38164	41771	45756	50226	55184	70305	74632	92379	97963	103844
12	TOTAL G AND E EXPENSE	0	763292	835426	915132	1003782	1103067	1171750	1243880	1319702	1399478	1483487

Figure 22

CHAPTER VI

GENERATING ALTERNATIVE PLANS: USE OF THE SYSTEM DRIVER

We have stated that the main advantage of simulation is that it permits planners to experiment, to answer the "what if...?" questions without actually manipulating the organization. Simulation enables the planner to examine various alternatives or combinations of alternatives and then to select the ones that appear best, or most likely, for actual implementation. With simulation, for example, the planners can see the results of a change in the student-faculty ratio without actually hiring (or firing) faculty members. In many such experiments it is often useful to consider precise values for certain items. For instance, what happens if the student-faculty ratio is 10 to 1, 12 to 1, 15 to 1, 18 to 1, or 20 to 1? In other cases, due to lack of precise data, it may not only be desirable but necessary to examine a range of values for certain planning items. For example, the interest on a loan that a college is considering taking out in 5 years may be anywhere from 5 to 8 percent; the planners have no way of knowing exactly what the interest rates will be in 5 years. In all cases there is a need for an efficient means for producing plans that incorporate the various alternatives.

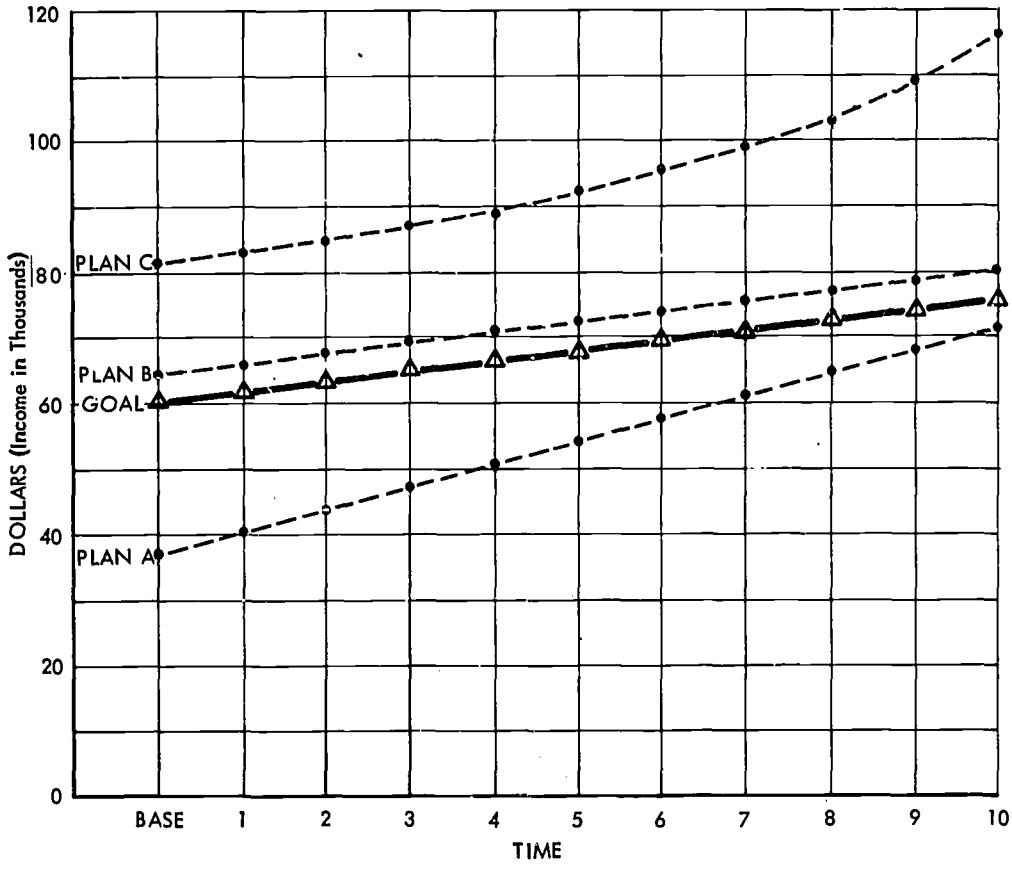
To satisfy this need simply and effectively, the PLANTRAN system uses a "system driver." It is called a system driver because it drives, or steps, the system through successive, planner-specified alternatives. This system capability works as follows: The base plan is entered and executed, generating the projections necessary to balance the total simulation equation. Next, the system reads change cards representing a different or alternative projection of a set of one or more planning items. The entire planning matrix is recomputed to bring the simulation equation back into balance, and the alternative plan is generated.

The computer handles each set of changes sequentially, and computes the associated plan. Since there is no limit to the number of changes that may be initiated, the planner may design an experiment to sweep through literally hundreds of alternatives, thus examining a large solution space for feasible alternatives.

Table I and Figure 23 illustrate the uses and benefits of the system driver. Table I shows the dollar values for the base period and each year of the 10-year planning horizon. The dollar values are given for the goal and for three alternative plans. Figure 23 is a graphical illustration relating dollars and time; the plotted lines show the values of each of the three alternative plans and the goal, or objective, values.

TABLE I

	Base ($)	Yr. 1 ($)	Yr. 2 ($)	Yr. 3 ($)	Yr. 4 ($)	Yr. 5 ($)	Yr. 6 ($)	Yr. 7 ($)	Yr. 8 ($)	Yr. 9 ($)	Yr. 10 ($)
GOAL VALUE	60,000	60,600	61,200	61,800	62,400	63,000	63,600	64,200	64,800	65,400	66,000
ALTERNATIVE A	37,500	39,950	42,300	44,750	47,200	49,650	52,100	54,550	57,000	59,450	61,900
ALTERNATIVE B	64,500	65,050	65,600	66,150	66,700	67,250	67,800	68,350	68,900	69,450	70,000
ALTERNATIVE C	81,500	83,375	85,250	87,125	89,000	92,250	95,750	99,500	103,000	109,750	116,500



GRAPH RELATING ALTERNATIVE PLAN VS. GOAL VALUES

Figure 23

(It should be noted that the normal system output is numeric; the graph here is for illustration.)

The graph in Figure 23 highlights the comparison process that the planner would follow in evaluating alternative plans. The goal line reflects the planner's knowledge of what can be realistically accommodated by the organization. The alternative lines show the computed effects of each of the alternatives. The planner may have changed several planning items to create an alternative. Such a technique enables the planner to learn more about the relationships between various planning components, experiment with several planning values to provide alternative solutions, and, then, compare the results with known objectives.

Use of the system driver in the PLANTRAN system is quite simple. The planner simply inserts cards reflecting his desired changes (the format is the same as the basic instruction input), and these cards replace the equivalent planning item line in the base model. Each instruction card that alters the plan must be followed by a "999" card (999 in card columns 1-3), and a card, or cards, denoting the desired report output (the format is the same as the summary report input). Next follows another "999" card, and, if desired, more change cards, a "999" card, report output cards, a "999" card, and so forth. Figure 24 shows the proper sequence of the data deck setup.

In using the system driver, it is important to note several things. First, the sequence of the change cards, a "999" card, the report output cards, a "999" card, etc., must be explicitly followed. Second, it must be kept in mind that from iteration to iteration the basic plan reflects the latest changes rather than the original plan values. If the planner desires the original value of a planning item rather than the current (latest) value, he must insert a change card restoring the original value. Third, the last "999" card must be followed by another "999" card denoting the end of the system run. Finally, the sequence of the computer printout must be understood. For the basic plan, a report titled "ANALYSIS OF PLANNING MATRIX" is printed. This report shows the line numbers, planning items, base values, code, method of computation, and total line, as well as the associated values for the entire planning horizon. Next comes the summary report, or reports, noting the planner-specified title, line numbers, base values, and planning horizon values. Then follows a description of the changes associated with the first iteration--ITERATION (n), a message, "THIS RUN CONTAINS CHANGES IN THE FOLLOWING INPUT LINES," a heading describing "LINE, CHANGE, BASE, CODE, METHOD OF COMPUTATION, ADD TO." Beneath this heading are printed the contents of the change cards.

The following pages will contain the summary reports requested and specified with the iteration. (Note that no "ANALYSIS OF PLANNING MATRIX" report is provided with the iterations.) The sequence of iteration information and summary report output is repeated until the end of the system run.

DATA DECK SETUP

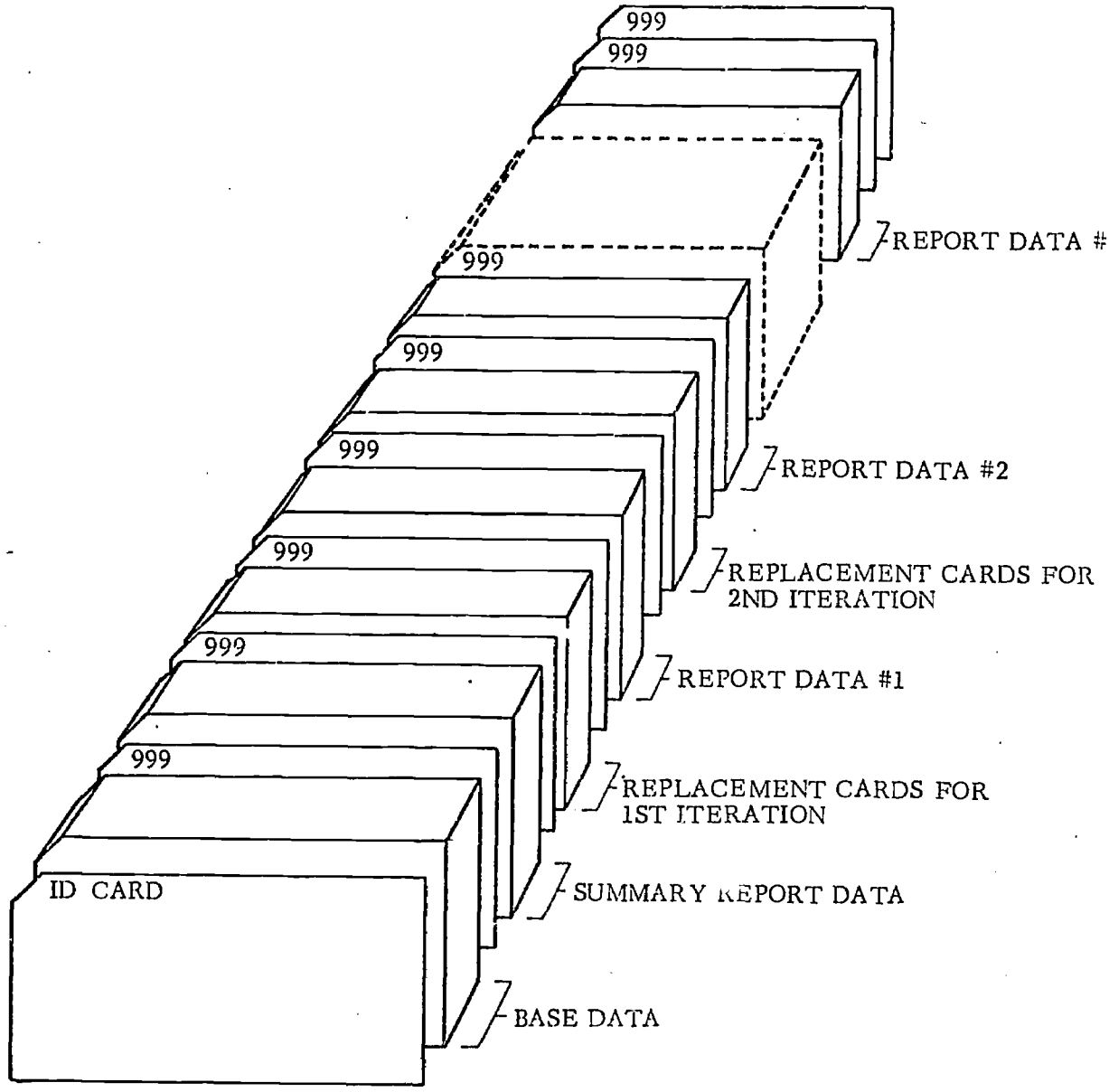


Figure 24

In summary, the system driver provides the planner with a simple method of designing experiments to evaluate alternatives. This capability enhances the benefit to be derived from the simulation activity by facilitating the generation of alternative plans.

CHAPTER VII

SUMMARY

The planner can use the planning system we have described to experiment with virtually every aspect of the organization. Such experimentation will enable him to see the consequences of various alternative actions. Figure 25 shows the concept of a "plan refining cycle"--the iterative process that would be logically associated with the development of a long-range plan. By examination and evaluation of the system output, the elements indicating need for changes are identified, and modifications can be made to independent variable values or dependent variable relationships. Thus, by changing the base plan, making a computer run, and reviewing the output, the effects of a certain decision can be noted quickly and efficiently.

The use of the planning system provides the planner with an almost infinite number of alternatives in designing a model to represent his organization. However, the high degree of freedom in both model and report design requires that the objectives of the organization be used as a basis for the planning process. It is for that reason that a systematic means of applying knowledge of the organization--such as use of the outline of plans worksheet--must be used to insure inclusion of the desired objectives, knowledge, and level of detail and to define the operation of the organization most accurately.

Planning is a dynamic process; it must be responsive to frequent change. The current trends of growth and complexity in the administration of education demand that today's planning be more accurate, rapid, and extensive than ever before. This computerized planning system provides a tool to meet that need.

ERIC

PLAN REFINING CYCLE

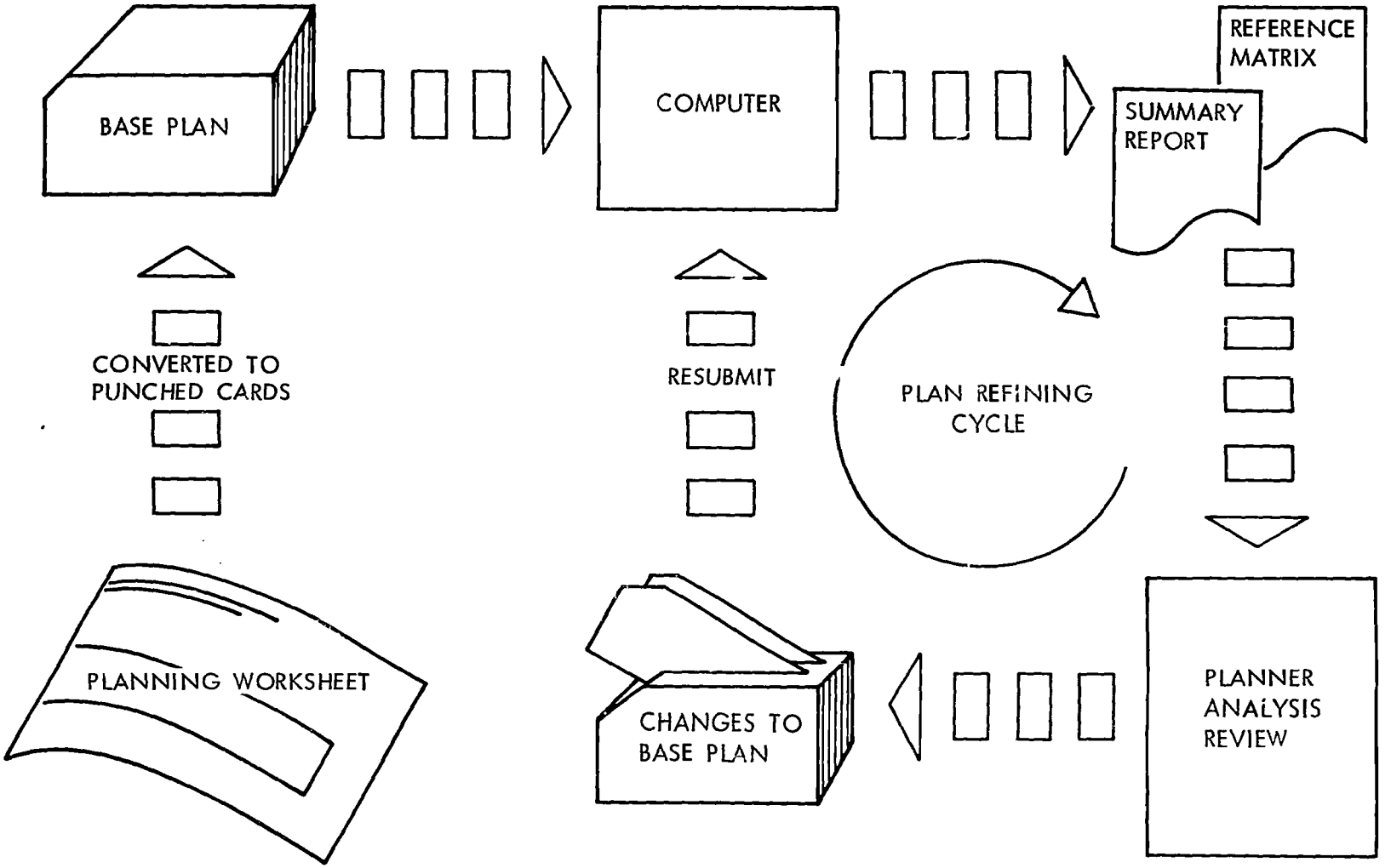


Figure 25

APPENDIX A

PLANTRAN EXERCISES

ERIC

PLANTRAN Exercises

The objective of these planning exercises is to provide the knowledge and skills required to design and manipulate organizational models using the PLANTRAN modeling language.

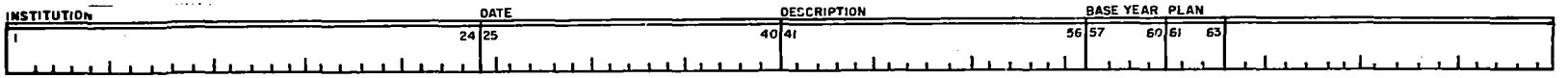
These sample exercises are provided to demonstrate the techniques used to identify the model, the instructions to project planning item values, and the specification for reports. Attention to the details of each of the techniques will enable one to understand the planning language concept and will aid in creating more meaningful models.

The exercises include examples of each PLANTRAN input format and all instructions in the language. The means of specifying a given instruction are flexible, varying from English-like statements to a very abbreviated code. We would urge that, at the start, the English-like statements be used to facilitate the learning process. As understanding of the language develops, the instruction statements may be abbreviated.

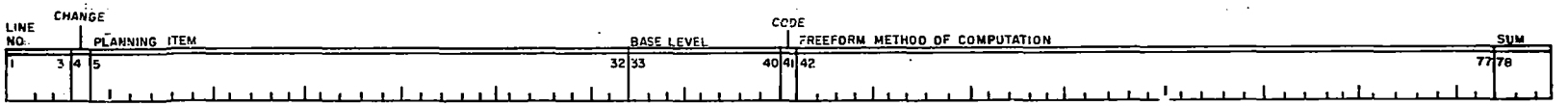
The answers to the exercises are found on the page following the individual exercise. Note that all the possible answers are not provided, only a sample of the various statements that will generate the correct identification, instruction, or report information. In addition, a sample program output relating to the exercise is provided beneath the sample answers.

* * PLANTRAN Langu[illegible] Input Formats * *

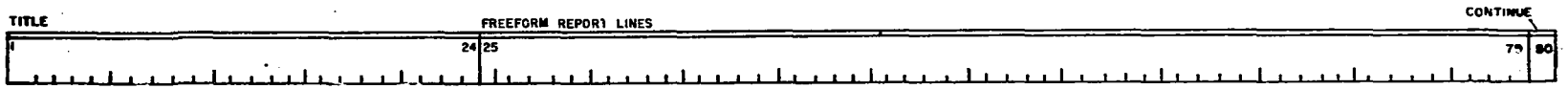
Identification Input—



Instruction Input—



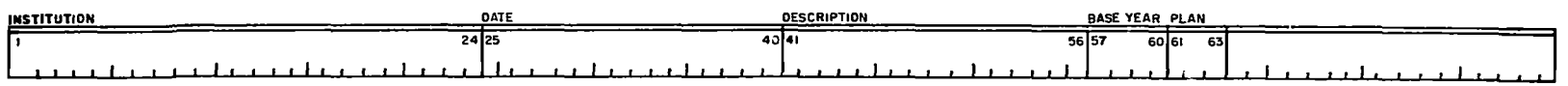
Summary Report Input—



* *

EXERCISE 1

Using the Plan Identification Data Sheet (below), provide the input data for: Sample College; the current date; Overview Model as a description; 1969 as the base year; and indication that this is the first plan.



SAMPLE ANSWER--EXERCISE 1

INSTITUTION	DATE	DESCRIPTION	BASE YEAR	PLAN
SAMPLE COLLEGE	CURRENT DATE	OVERVIEW MODEL	1969	1

REPORT SAMPLE COLLEGE OVERVIEW MODEL - 1 CURRENT DATE

PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979

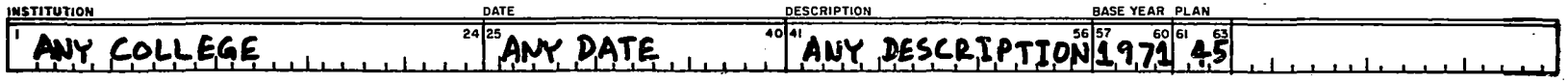
* * * * * * * * * * * * * * * * * * * *

EXERCISE 2

Provide the identification data for: your own, or any college; any date; any description; a base year such that the years 1972 through 1981 are included in the planning horizon; and a plan number of 45.

INSTITUTION	DATE	DESCRIPTION	BASE YEAR	PLAN
1 — 24	25 — 40	41 — 56	57 — 60	61 — 63

SAMPLE ANSWER--EXERCISE 2



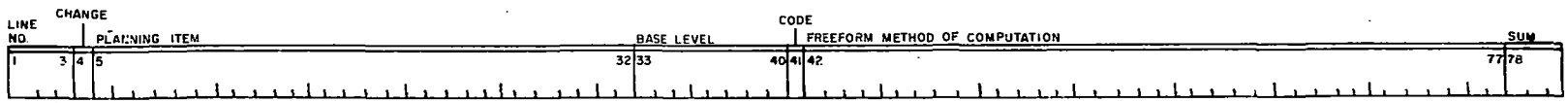
REPORT ANY COLLEGE ANY DESCRIPTION- 45 ANY DATE

PLANNING ITEM	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981

* * * * * * * * * * * * * * * * * * *

EXERCISE 3

Using the Instruction Data Sheet (below), enter the instruction to create a planning item with: a line number of 5; a name of Freshman; a base level of 300; a code to indicate change by a percentage; a percentage value of 3.5 percent; and to be totaled into line 9 (Total Enrollment).



SAMPLE ANSWERS--EXERCISE 3

LINE NO.	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
1 3	4	5 32	33 40	41	42 77	78
	5	FRESHMAN	300.	2	CHANGE BY 3.5% PER PERIOD	9
	5	FRESHMAN	300.	2	INCREASE BY 3.5 PERCENT PER PERIOD	9
	5	FRESHMAN	300.	2	INCR 3.5% /PR	9
	5	FRESHMAN	300.	2	I,3.5	9
	5	FRESHMAN	300.	2	3.5	9

PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
5 FRESHMAN	300.0	310.5	321.4	332.6	344.3	356.3	368.7	381.7	395.0	408.9	423.2

* * * * * * * * * * * * * * * * * * * *

EXERCISE 4

Provide the data to specify a planning item with: a line number of 7; called Special Students; denoting a decreasing percentage change of 5 percent; and a current level of 46.

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
1 3	4	5 32	33 40	41	42 77	78

SAMPLE ANSWERS--EXERCISE 4

LINE NO.	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
7		SPECIAL STUDENTS	46.	2	CHANGE BY -5% PER PERIOD	
7		SPECIAL STUDENTS	46.	2	DECREASE 5.0% PER PERIOD	
7		SPECIAL STUDENTS	46.	2	DECR 5. PERCENT / PR	
7		SPECIAL STUDENTS	46.	2	D,5	
7		SPECIAL STUDENTS	46.	2	-5	

PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
7 SPECIAL STUDENTS	46.0	43.7	41.5	39.4	37.5	35.6	33.8	32.1	30.5	29.0	27.5

* * * * * * * * * * * * * * * * * * * *

EXERCISE 5

Using the Instruction Data Sheet (below), enter the instruction to create a planning item with: a line number of 35; a planning item name of Professors; a base level of 30; a code to show change by an increment; a change of 2 per year; and to be totaled in line 39 (Total Faculty).

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM

SAMPLE ANSWERS--EXERCISE 5

LINE NO.	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
35		PROFESSORS	30.	3	CHANGE BY 2 PER PERIOD	39
35		PROFESSORS	30.	3	INCREASE +2. PER PERIOD	39
35		PROFESSORS	30.	3	INCR 2/PR	39
35		PROFESSORS	30.	3	I,2	39
35		PROFESSORS	30.	3	2	39

PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
35 PROFESSORS	30.0	32.0	34.0	36.0	38.0	40.0	42.0	44.0	46.0	48.0	50.0

* * * * * * * * * * * * * * * * * * * *

EXERCISE 6

Provide the data to generate the planning item called Freshman; line number 5; base level of 300; an increase of 10 per year; and totaled on line 11 (Total Students).

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM

SAMPLE ANSWERS--EXERCISE 6

LINE NO.	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
5		FRESHMAN	300.3		CHANGE BY 10 PER PERIOD	11
5		FRESHMAN	300.3		INCREASE BY 10.0 / PERIOD	11
5		FRESHMAN	300.3		INCR 10/PR	11
5		FRESHMAN	300.3		I,10	11
5		FRESHMAN	300.3		10	11

PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
5 FRESHMAN	300.0	310.0	320.0	330.0	340.0	350.0	360.0	370.0	380.0	390.0	400.0

* * * * * * * * * * * * * * * * * *

EXERCISE 7

Provide the instruction to generate a planning item called Student-Faculty Ratio; a line number of 9; a base to reflect a 16:1 current value; a code to show change to a goal level; a goal value of 20:1; and the goal to be achieved [illegible] years.

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM

SAMPLE ANSWERS--EXERCISE 7

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
9		STUDENT-FACULTY RATIO	16.	4	CHANGE TO 20 IN P4 PERIOD	
9		STUDENT-FACULTY RATIO	16.	4	INCREASE TO +20. IN P4	
9		STUDENT-FACULTY RATIO	16.	4	INCR 20 P4	
9		STUDENT-FACULTY RATIO	16.	4	I 20. P4	
9		STUDENT-FACULTY RATIO	16.	4	20. P4	

PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
9 STUDENT-FACULTY RATIO	16.0	17.0	18.0	19.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0

* * * * * * * * * * * * * * * * * * * *

EXERCISE 9

Provide the data to create an Average Faculty Salary planning item; with a line number of 23; a change ID number of 2; a current level of 10500; and a goal of 13750 to be reached in 5 years.

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM

SAMPLE ANSWERS--EXERCISE 8

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
232		AVERAGE FACULTY SALARY	10500.	4	CHANGE TO 13750 IN P5 PERIOD	
232		AVERAGE FACULTY SALARY	10500.	4	INCREASE TO 13750. IN P 5	
232		AVERAGE FACULTY SALARY	10500.	4	INCREASE 13750. P5	
232		AVERAGE FACULTY SALARY	10500.	4	I,13750 P5	
232		AVERAGE FACULTY SALARY	10500.	4	13750 P5	

PLANNING ITEM		1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
23	AVERAGE FACULTY SALARY	10500	11150	11800	12450	13100	13750	13750	13750	13750	13750	13750

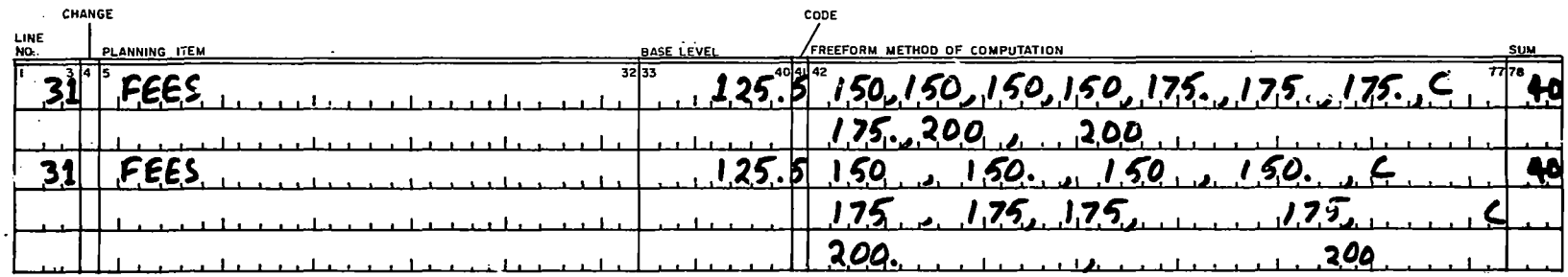
* * * * * * * * * * * * * * * * * * * *

EXERCISE 9

Provide the input data to generate a planning item called Fees; with a line number of 31; a base level of 125; a code to show insertion of constant data; with constant values of 150 for years 1-4, 175 for years 5-8, and 200 for years 9-10; and to be totaled on line 40 (Total Student Expenses).

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM

SAMPLE ANSWERS--EXERCISE 9

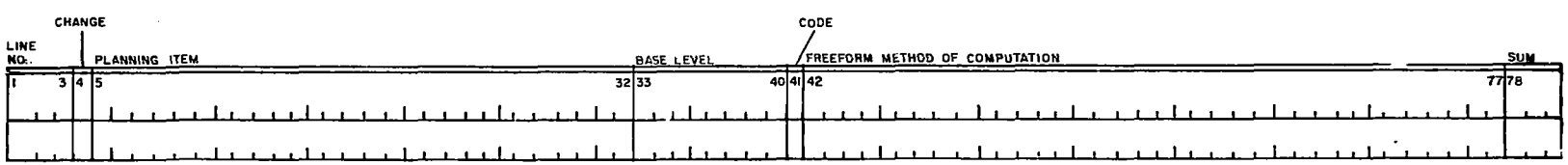


PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
31 FEES	125.0	150.0	150.0	150.0	150.0	175.0	175.0	175.0	175.0	200.0	200.0

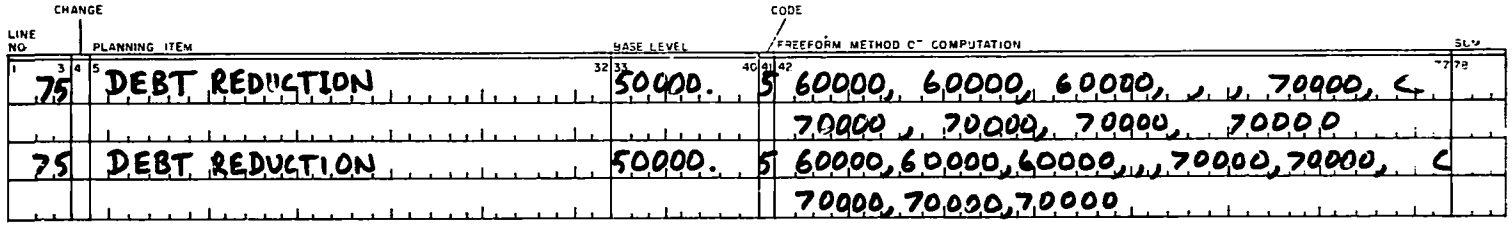
* * * * * * * * * * * * * * * * * * * *

EXERCISE 10

Generate a planning item called Debt Reduction; line number 75; a base value of 50000; and with values of 60000 for years 1-3 and 70000 for years 6-10.



SAMPLE ANSWERS--EXERCISE 10

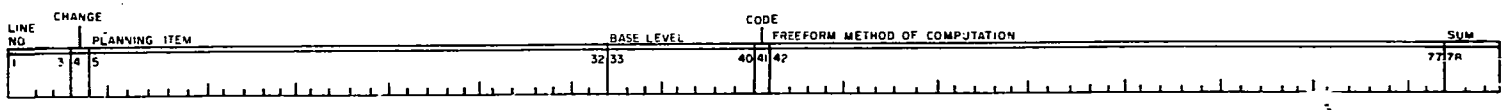


PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
75 DEBT REDUCTIO	50000	60000	60000	60000	0	0	70000	70000	70000	70000	70000

* * * * * * * * * * * * * * * * * * * *

EXERCISE 11

Write the instruction data to create a planning item called Total Student Expenses; a code to show that it is summed from other lines; a line number of 40; and note that lines 31, 33, 35, and 37 are totaled in the summary.



SAMPLE ANSWERS--EXERCISE 11

LINE NO.	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
40		TOTAL STUDENT EXPENSES		1	SUMMARY OF LINES 31, 33, 35, AND 37	
40		TOTAL STUDENT EXPENSES		1	TOTAL OF 31, 33, 35, 37	
40		TOTAL STUDENT EXPENSES		1		

	PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
31	TUITION-FEES PER YEAR	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
33	ROOM-BOARD PER YEAR	800	850	900	950	1000	1050	1100	1150	1200	1250	1300
35	BOOKS-SUPPLIES PER YEAR	150.0	162.0	175.0	189.0	204.1	220.4	238.0	257.1	277.6	299.9	323.8
37	ACTIVITY TICKETS	25.0	26.2	27.6	28.9	30.4	31.9	33.5	35.2	36.9	38.8	40.7
40	TOTAL STUDENT EXPENSES	0	2138	2302	2467	2634	2802	2971	3142	3314	3488	3664

* * * * * * * * * * * * * * * * * * * *

EXERCISE 12

Provide the data for a line number 39; called Total Faculty; a base value of 143; including the sum of lines 35, 36, 37, and 38; and to be totaled in line 65 (Total Employees).

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM

SAMPLE ANSWERS--EXERCISE 12

LINE NO.	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
39		TOTAL FACULTY	143.	1	SUMMARY OF LINES 35, 36, 37, AND 38	65
39		TOTAL FACULTY	143.	1	TOTAL OF 35,36,37,38	65
39		TOTAL FACULTY	143.	1		65

	PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
35	FULL PROFESSORS	33.0	31.7	30.3	29.0	27.7	26.3	25.0	25.0	25.0	25.0	25.0
36	ASSOCIATE PROFESSORS	27.0	28.1	29.2	30.4	31.5	32.6	33.8	34.9	36.0	36.0	36.0
37	ASSISTANT PROFESSORS	41.0	40.0	39.0	38.0	37.0	36.0	35.0	34.0	33.0	32.0	31.0
38	INSTRUCTORS	42.0	39.9	37.7	35.6	33.5	31.4	29.2	27.1	25.0	25.0	25.0
39	TOTAL FACULTY	143.0	139.7	136.3	133.0	129.7	126.3	123.0	121.0	119.0	118.0	117.0

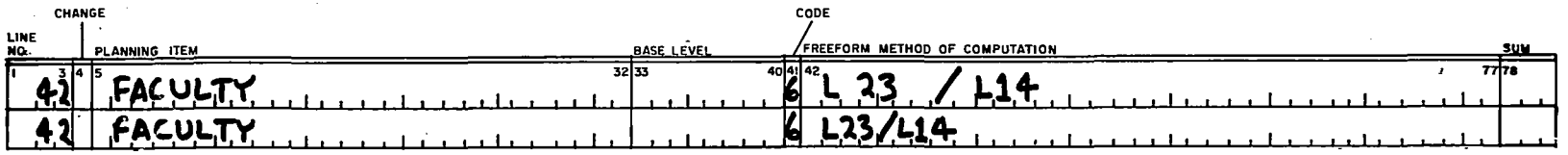
* * * * * * * * * * * * * * * * * * *

EXERCISE 13

Furnish the data for a planning item called Faculty; a line number of 42; a code to show the item is a function of other variables; and to be computed by dividing line 14 (Student-Faculty Ratio) into line 23 (Total Students).

LINE NO.	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM

SAMPLE ANSWERS--EXERCISE 13

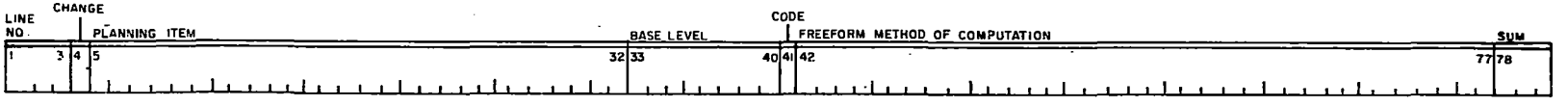


	PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
14	STUDENT-FACULTY RATIO	14.2	14.8	15.4	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
23	TOTAL STUDENTS	779	798	827	863	906	949	991	1034	1077	1119	1162
42	FACULTY	-0.0	53.9	53.7	53.9	56.6	59.3	61.9	64.6	67.3	69.9	72.6

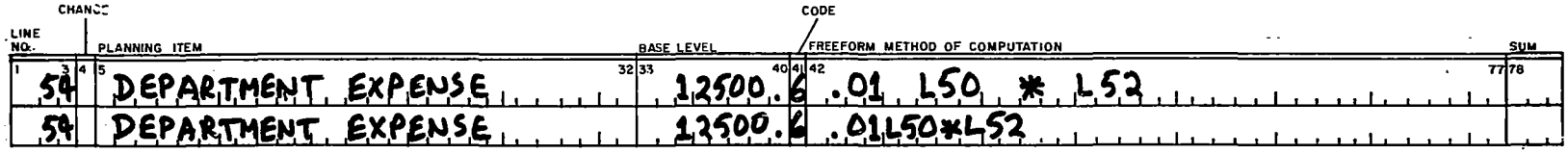
* * * * * * * * * * * * * * * * * * * *

EXERCISE 14

Enter a planning item with a line number of 54; called Department Expense; with a base level of 12500; computed by multiplying .01 times line 50 (Department Expense as Percent G & E and multiplying the product times line 52 (G & E Expense).



SAMPLE ANSWERS--EXERCISE 14

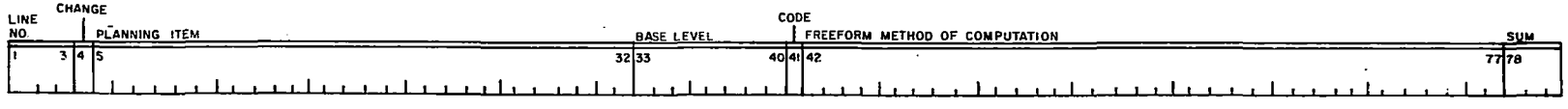


PLANNING ITEM		1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
50	DEPT EXPENSE AS PERCENT G+E	12.5	13.4	14.3	15.2	16.2	17.1	18.0	18.0	18.0	18.0	18.0
52	G + E EXPENSE	100000	110000	120000	130000	140000	150000	160000	170000	180000	190000	200000
54	DEPARTMENT EXPENSE	12500	14758	17199	19824	22633	25624	28799	30599	32399	34199	35999

* * * * * * * * * * * * * * * * * * * *

EXERCISE 15

Provide a planning item called Tuition; a line number of 34; a code denoting maximum of other planning items; which is derived from scanning lines 32 and 33 (Tuition Plan A and Tuition Plan B), which is the maximum of the two lines; and to be totaled on line 64 (Student Expenses).



SAMPLE ANSWERS--EXERCISE 15

LINE NO.	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
34		TUITION		8	MAX OF 32,33	64
34		TUITION		8	MAX 32,33	64
34		TUITION		8	A 32,33	64

	PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
32	TUITION PLAN A	1000	1080	1160	1240	1320	1400	1480	1560	1640	1720	1800
33	TUITION PLAN B	1000	1120	1240	1360	1480	1600	1600	1600	1600	1600	1600
34	TUITION	1000	1120	1240	1360	1480	1600	1600	1600	1640	1720	1800

* * * * * * * * * * * * * * * * * * * *

EXERCISE 16

Create a planning item called Instructor's Salary; with a line number of 38, which is determined by examining lines 27 and 28 (Instructor and Instructor Check Line); and generating the minimum of the two lines.

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
1 3	4	5 32	33 40	41	42 77	78

SAMPLE ANSWERS--EXERCISE 16

LINE NO.	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
38		INSTRUCTOR'S SALARY		8	MIN OF 27,28	
38		INSTRUCTOR'S SALARY		8	MIN 27,28	
38		INSTRUCTOR'S SALARY		8	I 27,28	

PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
27 INSTRUCTOR	8100	8585	9101	9647	10226	10839	11490	12179	12910	13684	14505
28 INSTRUCTOR CHECK LINE	8100	9514	8928	9342	9757	10171	10585	11000	11000	11000	11000
38 INSTRUCTOR SALARY	8100	8514	8928	9342	9757	10171	10585	11000	11000	11000	11000

* * * * * * * * * * * * * * * * * * * *

EXERCISE 17

Provide the data for a line called Cum Operating Surplus; a line number of 86; a base value of 123750; and to be the accumulative sum of line 85 (Operating Surplus).

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM

SAMPLE ANSWERS--EXERCISE 17

LINE NO.	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
86		CUM OPERATING SURPLUS	123750.	9	SUM OF LINE 85	
86		CUM OPERATING SURPLUS	123750.	9	SUM OF 85	
86		CUM OPERATING SURPLUS	123750.	9	SUM 85	
86		CUM OPERATING SURPLUS	123750.	9	S,85	

	PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
85	OPERATING SURPLUS	123750	24127	16311	8468	2533	4261	5375	9123	11246	9746	6245
86	CUM OPERATING SURPLUS	123750	147877	164188	172656	175191	179452	184827	193950	205196	214932	221177

* * * * * * * * * * * * * * * * * * * *

EXERCISE 18

Enter the input data for a planning item with a line number of 58; a name of Product Line; a base value of 2.5; and to be the accumulative product of line 55 (Formula).

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM

SAMPLE ANSWERS--EXERCISE 18

LINE NO.	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
58		PRODUCT LINE	2.59		PROD OF LINE 55	
58		PRODUCT LINE	2.59		PROD OF 55	
58		PRODUCT LINE	2.59		PROD 55	
58		PRODUCT LINE	2.59		P.55	

	PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
55	FORMULA	2.5	2.4	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.5
58	PRODUCT LINE	2	6	13	30	63	127	242	436	741	1186	1779

* *

EXERCISE 19

Show the input for a planning item with a line number of 7; called Potential Sophomore; a base level of 290; a code to denote the last year's value of another planning item; and to be derived by taking line number 6 (Freshman) and shifting the data one period.

LINE NO.	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM

SAMPLE ANSWERS--EXERCISE 19

LINE NO.	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
	7	POTENTIAL SOPHOMORE	238.	7	SHIFT 1. OF L6	
	7	POTENTIAL SOPHOMORE	238.	7	SHIFT L6	
	7	POTENTIAL SOPHOMORE	238.	7	L6	

	PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
6	FRESHMAN	300.0	310.0	320.0	330.0	340.0	350.0	360.0	370.0	380.0	390.0	400.0
7	POTENTIAL SOPHOMORES	290.0	300.0	310.0	320.0	330.0	340.0	350.0	360.0	370.0	380.0	390.0

* *

EXERCISE 20

Provide a planning item called Junior; line number 8; determined by taking .65 times line 7 (Sophomore), shifted one period; and to be totaled on line 10 (Total Students).

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM

SAMPLE ANSWERS--EXERCISE 20

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
8		JUNIOR		7	.65 DIAGONAL L7	10
8		JUNIOR		7	SHIFT .65 TIMES L7	10
8		JUNIOR		7	.65L7	10

PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
7 SOPHOMORE	239.0	237.1	241.9	246.7	251.7	256.7	261.8	267.1	272.4	277.9	283.4
8 JUNIOR	150.0	154.7	154.1	157.2	160.4	163.6	166.8	170.2	173.6	177.1	180.6

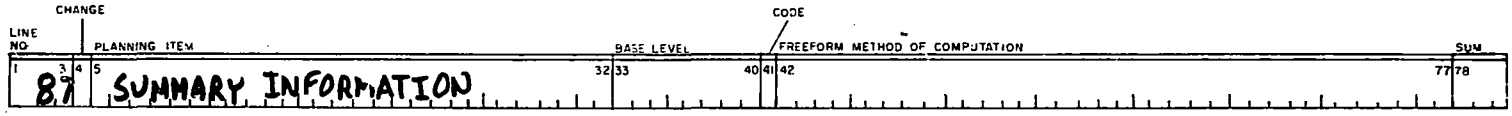
****

EXERCISE 21

Provide the input for a line number 87; named Summary Information; a code to denote that the planning item is a heading.

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
1 3	4	5 32	33 40	41	42 77	78

SAMPLE ANSWER--EXERCISE 21



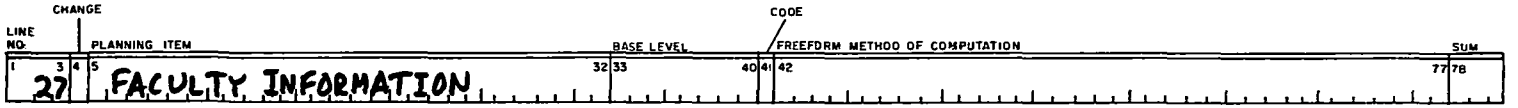
PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
SUMMARY INFORMATION											

* * * * * * * * * * * * * * * * * * * *

EXERCISE 22

Provide the input data for a heading with a line number of 27; a name of Faculty Information.

SAMPLE ANSWER--EXERCISE 22

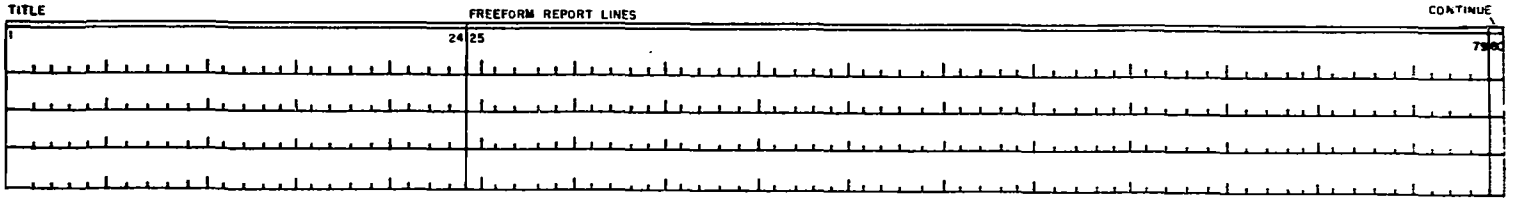


PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
FACULTY INFORMATION											

* * * * * * * * * * * * * * * * * * * *

EXERCISE 23

Using the Summary Report Data Sheet (below), provide the input to create four summary reports: Students, using lines 1, 2, and 4; Faculty, using lines 5, 6, 7, and 8; Income, using lines 3 and 14; and Expenses, using lines 7, 9, 10, 13, and 12.



SAMPLE ANSWER--EXERCISE 23

TITLE (1–24)	FREEFORM REPORT LINES (25–72)
STUDENTS	1,2,4
FACULTY	5-8
INCOME	3,14
EXPENSES	7,9,10,13,12

NOTE:

The summary reports generated by the above statements are shown on the following page. For the sample, each of the four reports is combined onto a single page. The actual system output would separate each report specified by a unique Summary Report Input statement and print it on a page, or pages, as required. This ability to specify unique reports relating to a certain aspect of planning enables the planner to create reports appropriate to his needs.

* *

SUMMARY REPORT STUDENTS

	PLANNING ITEM	BASE	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR10
1	STUDENTS	800	823	848	874	900	927	955	983	1013	1043	1075
2	FEES / STUDENT	550	588	629	673	720	771	825	883	945	1011	1081
4	STUDENT-FACULTY RATIO	23.0	22.0	21.0	20.0	19.0	18.0	18.0	18.0	18.0	18.0	18.0

SUMMARY REPORT FACULTY

	PLANNING ITEM	BASE	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR10
5	FACULTY	-0.0	37.5	40.4	43.7	47.4	51.5	53.1	54.7	56.3	58.0	59.7
6	AVERAGE FACULTY COMPENSATION	10500	10919	11356	11811	12283	12774	13285	13817	14369	14944	15542
7	TOTAL FACULTY COMPENSATION	0	409003	458987	516251	582113	658202	705066	755267	809042	866646	928351
8	DEPARTMENT EXPENSE/FACULTY	500.0	515.0	530.4	546.4	562.8	579.6	597.0	614.9	633.4	652.4	672.0

SUMMARY REPORT INCOME

	PLANNING ITEM	BASE	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR10
3	TOTAL FEE INCOME	0	484923	534434	589000	649137	715414	788458	868959	957680	1055459	1163222
14	NON-FEE INCOME	0	278368	300991	326131	354645	387653	383291	374920	362021	344018	320265

SUMMARY REPORT EXPENSES

	PLANNING ITEM	BASE	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR10
7	TOTAL FACULTY COMPENSATION	0	409003	458987	516251	582113	658202	705066	755267	809042	866646	928351
9	TOTAL DEPARTMENT EXPENSE	0	19284	21438	23881	26668	29864	31683	33613	35660	37831	40135
10	ADMIN AND GEN EXPENSE	315000	335000	355000	375000	395000	415000	435000	455000	475000	495000	515000
13	LIBRARY	0	38164	41771	45756	60226	66184	70305	74632	92379	97963	103844
12	TOTAL G AND E EXPENSE	0	763292	835426	915132	1003782	1103067	1171750	1243880	1319702	1399478	1483687

APPENDIX B

SAMPLE COLLEGE MODEL

ERIC

SAMPLE COLLEGE MODEL

This appendix is provided to give an example of a model for an institution. The brief description of "Sample College" is followed by the Planning Simulator System input statements. The Summary Report output follows, and finally, the Analysis of Planning Matrix Report.

A review of this appendix should give the planner an understanding of the levels of detail associated with model design.

SAMPLE COLLEGE

Sample College was founded in 1864. From its early beginning of four teachers and nine students, Sample College has grown to its present faculty of 50 and a total enrollment of 779. It is the intent of the faculty and administration to continue to grow to about 1,000 students in the next 6 years, and onward at about that same rate. This growth will be accomplished by increasing the size of the entering freshman class by 15 students each year, a goal which appears reasonable to the Admissions office.

Dormitory residents now number 615, or 79 percent of the total head count. Due to the increasing tendency of Sample College students to provide their own housing off campus, and due to the decreasing popularity of dormitory-living, the college anticipates that as the enrollment increases, the percentage of students who will be living in dormitories will decrease to 70 percent over the 10-year period. The present ratio of 60 percent men, 40 percent women residents is expected to continue. Since the college now has residence hall capacity of about 650, there will be a need for additional dormitory facilities in about 5 years.

The costs of operating the college will continue to rise, though the college cannot say exactly how much. However, the college tentatively anticipates raising the tuition charge from its present level of $1,000 per year to a level of $2,000 per year over the 10-year period, going up in increments of $100 each year. Some of the faculty point out that Sample College is a good college, which has traditionally served the youth from its state, "Midwest," and that it is cruel to raise the charges so steeply. The Trustees claim that if the college is as good as it thinks it is, the college should charge as much as other schools of the same caliber, some of which are already at $2,000 per year. The present anticipated increase of $100 per year is a tentative compromise figure. An increase in room and board of $50 per year and an increase of books and supplies of 8 percent a year are considered sufficient to keep up with market conditions.

The 50 faculty members are distributed among the ranks with 16 (32 percent) as instructors, 14 (28 percent) as assistant professors, 9 (18 percent) as associate professors, and 11 (22 percent) as full professors. As the student body increases, the college anticipates changing from its present 14.2 students per faculty member to 16.0 over a period of 3 years. This will cause a slight drop in the total number of faculty positions in the next 2 years, but then will increase to 66 positions in the 10th year.

The levels of faculty compensation are adequate for the area, the overall average now being $9,400. The college plans on increasing this figure to $16,500 over the 10-year period. Fringe benefits now represent 8.5 percent of salaries and are expected to increase to 15 percent in the 10-year period.

The average credit-hour load per faculty member is currently 14.0 hours per semester. In response to repeated suggestions from a faculty committee, the college hopes to drop this credit hour load to a 10-hour load over a period of 6 years. The combined effect of reducing teaching loads over a period of 6 years and increasing the student-faculty ratio over a period of 3 years is indicated in the resulting average class size. That figure is currently 15.2 students per class, will increase to 20.0 in 3 years, then will continue to increase, at a somewhat slower rate, to 24.0 over the following 3 years.

The average class size, incidentally, is calculated by relating four other figures: the average student load, the full-time equivalent number of students, the average faculty load, and the full-time equivalent faculty. The formula is:

$$\frac{\text{students X load}}{\text{faculty X load}} = \frac{\text{hours earned}}{\text{hours taught}} = \text{average class size}$$

The Sample College Library presently holds 43,000 volumes. The college is assuming that these holdings will increase approximately three volumes per FTE student each year. This will result in library holding of slightly more than 69,000 volumes at the end of the 10-year period. The 200 periodical subscriptions are considered to be inadequate, so the college anticipates increasing the periodical list to 500 titles over the next 7 years. The cost of books now averages $8 per volume, but appears to be increasing at about 6 percent per year. The periodical cost is now $14 per title, and is expected to increase by about 10 percent per year. A cost figure for administration and services of the library appears to equal 75 cents per volume held plus $5 per student. This is the basis for calculating the library budget.

Income Budget

To account for attrition between semesters and other variations and changes, the fee income is calculated by multiplying annual fees times fall FTE enrollment, then taking 96 percent of the resulting figure. This formula has been fairly consistent over the past 3 years.

Endowment income is presently only $3,750, but with a new and energetic staff man in the development office, the college believes that this income can be increased to $100,000 per year. This means that the endowment portfolio will have to increase from its present $75,000 to $2,000,000.

Gifts and grants for general operations currently amount to $112,049, and can reasonably be expected to increase by 10 percent per year. Other income is anticipated to increase at a modest 5 percent per year.

Residence hall income is calculated by taking residence hall fee times the number of resident students. Although there is some attrition between semesters, this is generally balanced by guest charges and the use of residence halls for some summer conferences.

Bookstore income results from books and supplies times the number of FTE students. Although not all of the students' money for books and supplies is spent at the bookstore, neither is all the bookstore income generated by students. Faculty purchases, some office supplies, and alumni and visitor souvenir purchases make up the difference.

The student aid income has two sources, one being the endowed aid, which can be expected to increase by 10 percent per year, and the second being the special gifts, which, through special appeals, are expected to increase by 15 percent per year. The endowment portfolio for student aid currently stands at $1,074,200 and will have to be increased to $2,786,198 if the 10 percent per year income increase is reasonable.

Expense Budget

At present the expense figures for college-wide operations are expected to increase at the following rates:

	Percent Increase
General administration	4
Student services	7
Public relations	6
General institutional expense	3
Plant operation and maintenance	5

ERIC

The budgets for instruction and the library were calculated on specific program data, detailed above.

Expenses for residence halls and the bookstore are expected to represent 90 percent and 83 percent of the income for those items, showing an operating surplus.

The income for financial aid is added to the operating surplus for auxiliary enterprises to make up the amount available for student financial aid expense.

Analyses

The most obvious analysis is to compare the total current income with the total current expense. This currently yields a loss of $534,454, expressed as a negative surplus. To learn the long-range effects of the projections and assumptions detailed above, the figures for operating surplus are accumulated throughout the 10-year period to a total of -$5,918,281.

Another type of analysis is to indicate the percent of the educational and general budget represented by the various components. Thus, we can see that based on the projections, instruction can be expected to climb from its present 38.5 percent to an eventual 59.4 percent of a total budget. The library will go from its present 3.5 percent to a high of 4.1 percent then drop to 4.0 percent. At no time, however, would the library be receiving the level of support recommended by the National Library Association or the accrediting agencies.

Student fees are currently supplying just half the total educational and general budget; according to the assumptions and projections, they will be paying two-thirds of the budget in the 10th year.

The calculations also show that financial aid expense represents 22.6 percent of student fees, but will decrease to about 19 or 20 percent over the planning period. This means that even though the college is increasing both the costs per student and the number of students, financial aid is keeping about even with its present level of support.

The figures for general and financial aid endowment funds are based on the desired results, indicated above, and the assumption that they represent a 5 percent income.

PLAN IDENTIFICATION DATA SHEET

Name _____

Project _____

MRI

INSTITUTION (1–24)	DATE (25–40)	DESCRIPTION (41–56)	BASE YEAR (57–60)	PLAN (61–63)
SAMPLE COLLEGE	CURRENT DATE	OVERALL MODEL	1969	1

INSTRUCTION DATA SHEET

MRI

Name _____

Project _____

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
1		STUDENTS				
2		FRESHMEN FALL HEAD COUNT	300.	3	INCREASE BY 15 PER YEAR	13
3		POTENTIAL SOPH		7	DIAGONAL OF LINE 2	
4		PCT RENENTION FR-SOPH	60.	2	INCREASE 0. PERCENT PER YEAR	
5		SOPHOMORES FALL HEAD COUNT	180.	6	L3 * .01 L4	13
6		POTENTIAL JRS		7	DIAGONAL OF LINE 5	
7		PCT RETENTION SOPH-JR	80.	2	INCREASE 0. PERCENT PER YEAR	
8		JUNIORS FALL HEAD COUNT	144.	6	L6 * .01 L7	13
9		POTENTIAL SENIORS		7	DIAGONAL OF LINE 8	
10		PCT RETENTION JR-SR	90.	2	INCREASE 0. PERCENT PER YEAR	
11		SENIORS FALL HEAD COUNT	130.	6	L9 * .01 L10	13
12		SPECIAL AND UNCLASSIFIED	25.	3	INCREASE 5 PER YEAR	13
13		TOTAL FALL HEAD COUNT	799.	1		
14		FULL TIME	660.	6	.85 L13	17
15		PART TIME	119.	6	L13 - L14	
16		FTE OF PART TIME	48.	6	.4 L15	17
17		TOTAL FALL FTE ENROLLMENT	708.	1		
18		RESIDENTS AS PCT HEAD COUNT	79.	4	CHANGE TO 70. IN P6 YEARS	
19		RESIDENT STUDENTS	615.	6	.01 L18 * L13	

INSTRUCTION DATA SHEET

MRI

Name _____

Project _____

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
20		RESIDENT MEN	370.	6	.60 L19	
21		RESIDENT WOMEN	245.	6	L19 - L20	
22		COMMUTING STUDENTS	164.	6	L13 - L19	
23		TUITION FEES PER YEAR	1000.	3	INCREASE 100 PER YEAR	26
24		ROOM-BOARD PER YEAR	800.	3	INCREASE 50 PER YEAR	26
25		BOOKS-SUPPLIES PER YEAR	150.	2	INCREASE 8 PERCENT PER YEAR	26
26		TOTAL STUDENT COSTS / YR	1950.	1		
27		FACULTY				
28		STUDENT-FACULTY RATIO	14.2	4	CHANGE TO 16 IN P3 YEARS	
29		FTE FACULTY-TEACHING	50.	6	L17 / L28	
30		INSTRUCTORS AS PCT FTE	32.	2	INCREASE 0. PERCENT PER YEAR	
31		ASST AS PCT FTE	28.	2	INCREASE 0. PERCENT PER YEAR	
32		ASSOC AS PCT FTE	18.	2	INCREASE 0. PERCENT PER YEAR	
33		PROF AS PCT FTE	22.	2	INCREASE 0. PERCENT PER YEAR	
34		INSTRUCTORS	16.	6	.01 L30 * L29	
35		ASSISTANT PROFESSORS	14.	6	.01 L31 * L29	
36		ASSOCIATE PROFESSORS	9.	6	.01 L32 * L29	
37		FULL PROFESSORS	11.	6	.01 L33 * L29	
38		FTE FACULTY ON SABBATICAL	4.	3	INCREASE .5 PER YEAR	

INSTRUCTION DATA SHEET

MRI

Name _____

Project _____

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
39		TOTAL FACULTY-BUDGET	54.	6	L29 + L38	
40		AVG FACULTY SALARY	9400.	4	CHANGE TO 16500 IN P10 YEARS	
41		FRINGES AS PCT SALARY	8.5	4	CHANGE TO 15 IN P10 YEARS	
42		FRINGES IN DOLLARS	800.	6	.01 L41 * L40	
43		AVERAGE FACULTY COMPENSATION	10200.	6	L40 + L42	
44		AVG FACULTY LOAD CREDIT HRS	14.	4	CHANGE TO 10 IN P6 YEARS	
45		AVERAGE CLASS SIZE	15.2	6	L17 / L29 / L44	
46		TOTAL FACULTY COSTS	510800.	6	L39 * L43	48
47		INSTRUCTIONAL SUPPORT	127700.	6	.25 L46	48
48		TOTAL INSTRUCTIONAL COSTS	638500.	1		
49		LIBRARY				
50		VOLUMES ADDED	43000.	6	3 L17	
51		VOLUMES HELD	43000.	9	ACCUM SUM OF LINE 50	
52		PERIODICAL SUBSCRIPTIONS	200.	4	CHANGE TO 500 IN 17 YEARS	
53		BOOK COST PER VOLUME	8.	2	INCREASE 6 PERCENT PER YEAR	
54		PERIODICAL COST/SUBSCRIPTION	14.	2	INCREASE 10 PERCENT PER YEAR	
55		COST OF BOOKS PURCHASED	2124.	6	L50 * L53	58
56		SUBSCRIPTION COSTS	2800.	6	L52 * L54	58
57		ADMINISTRATION AND SERVICE	35790.	6	.75 L51 + 5. L17	58

INSTRUCTION DATA SHEET

MRI

Name _____

Project _____

LINE NO	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
58		LIBRARY EXPENSES	40714.	1		
59		INCOME-EDUC AND GENL				
60		TUITION AND FEES	674000.	6	.96 L23 * L17	64
61		ENDOWMENT	3750.	4	CHANGE TO 100000 IN P10 YEARS	64
62		GIFTS AND GRANTS	112049.	2	INCREASE 10 PERCENT PER YEAR	64
63		OTHER	21311.	2	INCREASE 5 PERCENT PER YEAR	64
64		TOTAL EDUC GENL INCOME	811110.	1		74
65		AUXILIARY ENTERPRISE INCOME				
66		RESIDENCE HALL INCOME	492000.	6	L19 * L24	69
67		BOOKSTORE	106200.	6	L17 * L25	69
68		OTHER	3920.	2	INCREASE 5 PERCENT PER YEAR	69
69		TOTAL AUXILIARY INCOME	602120.	1		74
70		STUDENT AID INCOME				
71		ENDOWED STUDENT AID	53710.	2	INCREASE 10 PERCENT PER YEAR	73
72		SPECIAL GIFTS	29020.	2	INCREASE 15 PERCENT PER YEAR	73
73		TOTAL AID INCOME	83730.	1		74
74		TOTAL CURRENT INCOME	1496960.	1		
75		EXPENSE-EDUC AND GENL				
76		GENERAL ADMINISTRATION	169415.	2	INCREASE 4 PERCENT PER YEAR	83

INSTRUCTION DATA SHEET

MRI

Name _____

Project _____

LINE NO.	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
77		STUDENT SERVICES	132800.	2	INCREASE 7 PERCENT PER YEAR	83
78		PUBLIC RELATIONS	97450.	2	INCREASE 6 PERCENT PER YEAR	83
79		GENL INSTITUTIONAL EXPENSE	79385.	2	INCREASE 3 PERCENT PER YEAR	83
80		INSTRUCTION	638500.	6	L48	83
81		LIBRARY	40714.	6	L58	83
82		PLANT OPERTN AND MAINT	187300.	2	INCREASE 5 PERCENT PER YEAR	83
83		TOTAL-EDUC GENL EXPENSE	1345564.	1		90
84		AUXILIARIES				
85		RESIDENCE HALL EXPENSE	442800.	6	.9 L66	88
86		BOOKSTORE	88146.	6	.83 L67	88
87		OTHER	3920.	6	L68	88
88		TOTAL AUXILIARY EXPENSE	534866.	1		90
89		STUDENT FINANCIAL AID EXP	150984.	6	L69 - L88 + L73	90
90		TOTAL CURRENT EXPENSE	2031414.	1		
91		CURRENT OPERATING SURPLUS	-534454.	6	L74 - L90	
92		ACCUMULATED SURPLUS		9	ACCUMULATED SUM OF LINE 91	
93		ANALYSIS				
94		GEN ADMIN AS PCT ED-GEN	12.6	6	L76 / .01 L83	
95		STUDENT SERV AS PCT ED-GEN	9.8	6	L77 / .01 L83	

INSTRUCTION DATA SHEET

MRI

Name _____

Project _____

LINE NO.	CHANGE	PLANNING ITEM	BASE LEVEL	CODE	FREEFORM METHOD OF COMPUTATION	SUM
96		PUB REL AS PCT ED-GEN	7.3	6	L78 / .01 L83	
97		GEN INST AS PCT ED-GEN	5.9	6	L79 / .01 L83	
98		INSTRUCT AS PCT ED-GEN	38.5	6	L80 / .01 L83	
99		LIBRARY AS PCT ED-GEN	3.5	6	L81 / .01 L83	
100		PLANT AS PCT ED-GEN	14.2	6	L82 / .01 L83	
101		PCT ED-GEN PAID BY FEES	50.1	6	L60 / .01 L83	
102		FIN AID AS PCT STU FEES	22.6	6	L89 / .01 L60	
103		FIN AID AS DOLLARS PER STU	213.	6	L89 / L17	
104		GEN ENDOWMENT CORPUS	75000.	6	20. L61	
105		SCHOLARSHIP ENDOW CORPUS	1074200.	6	20. L71	

SUMMARY REPORT DATA SHEET

Name _____

Project _____

MRI

TITLE (1–24)	FREEFORM REPORT LINES (25–79)
STUDENT SUMMARY	2,5,8,11-13,17,20,21,19,22-26,28,101
FACULTY SUMMARY	34-37,29,38-41,43,44,28,45,98
LIBRARY SUMMARY	51,52,58,99
EDUC AND GENERAL	59-64,76-83
AUXILIARIES	65-69,84-88
FINANCIAL AID	70-73,89,103,105
FISCAL SUMMARY	64,69,73,74,83,88-92
SIGNIFICANT FACTORS	2,13,17,23-26,28,29,40,41,74,90,91,92,101,104,
	105
ANALYSIS SUMMARY	94-105

101

STUDENT SUMMARY REPORT — SAMPLE COLLEGE — OVERALL MODEL - 1 — CURRENT DATE

	PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	FRESHMEN FALL HEAD COUNT	300.0	315.0	330.0	345.0	360.0	375.0	390.0	405.0	420.0	435.0	450.0
5	SOPHOMORES FALL HEAD COUNT	180.0	180.0	189.0	198.0	207.0	216.0	225.0	234.0	243.0	252.0	261.0
8	JUNIORS FALL HEAD COUNT	144.0	144.0	144.0	151.2	158.4	165.6	172.8	180.0	187.2	194.4	201.6
11	SENIORS FALL HEAD COUNT	130.0	129.6	129.6	129.6	136.1	142.6	149.0	155.5	162.0	168.5	175.0
12	SPECIAL AND UNCLASSIFIED	25.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0	65.0	70.0	75.0
13	TOTAL FALL HEAD COUNT	779	798	827	863	906	949	991	1034	1077	1119	1162
17	TOTAL FALL FTE ENROLLMENT	708	726	753	786	824	863	902	941	980	1019	1057
20	RESIDENT MEN	370.0	371.3	377.4	386.1	397.0	407.2	416.6	434.5	452.4	470.3	488.3
21	RESIDENT WOMEN	245.0	247.6	251.6	257.4	264.7	271.5	277.7	289.7	301.6	313.6	325.5
19	RESIDENT STUDENTS	615.0	618.9	629.0	643.5	661.7	678.6	694.3	724.2	754.0	783.9	813.8
22	COMMUTING STUDENTS	164.0	179.7	198.6	220.3	244.7	270.5	297.6	310.4	323.2	336.0	348.8
23	TUITION FEES PER YEAR	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
24	ROOM-BOARD PER YEAR	800	850	900	950	1000	1050	1100	1150	1200	1250	1300
25	BOOKS-SUPPLIES PER YEAR	150.0	162.0	175.0	189.0	204.1	220.4	238.0	257.1	277.6	299.9	323.8
26	TOTAL STUDENT COSTS / YR	1950	2111	2274	2438	2604	2770	2938	3107	3277	3449	3623
28	STUDENT FACULTY RATIO	14.2	14.8	15.4	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
101	PCT ED-GENL PAID BY FEES	50.1	51.2	54.2	57.3	59.4	61.3	62.9	64.3	65.6	66.7	67.7

FACULTY SUMMARY REPORT SAMPLE COLLEGE OVERALL MODEL - 1 CURRENT DATE

	PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
34	INSTRUCTORS	16.0	15.7	15.6	15.7	16.5	17.3	18.1	18.8	19.6	20.4	21.2
35	ASSISTANT PROFESSORS	14.0	13.7	13.7	13.8	14.4	15.1	15.8	16.5	17.2	17.8	18.5
36	ASSOCIATE PROFESSORS	9.0	8.8	8.8	8.8	9.3	9.7	10.2	10.6	11.0	11.5	11.9
37	FULL PROFESSORS	11.0	10.8	10.8	10.8	11.3	11.9	12.4	12.9	13.5	14.0	14.5
29	FTE FACULTY-TEACHING	50.0	49.1	48.9	49.1	51.6	54.0	56.4	58.8	61.3	63.7	66.1
38	FTE FACULTY ON SABBATICAL	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0
39	TOTAL FACULTY-BUDGET	54.0	53.6	53.9	54.6	57.6	60.5	63.4	66.3	69.3	72.2	75.1
40	AVG FACULTY SALARY	9400	10110	10820	11530	12240	12950	13660	14370	15080	15790	16500
41	FRINGES AS PCT SALARY	8.5	9.1	9.8	10.4	11.1	11.7	12.4	13.0	13.7	14.3	15.0
43	AVERAGE FACULTY COMPENSATION	10200	11035	11880	12734	13598	14471	15353	16245	17145	18055	18974
44	AVG FACULTY LOAD CREDIT HRS	14.0	13.3	12.7	12.0	11.3	10.7	10.0	10.0	10.0	10.0	10.0
28	STUDENT FACULTY RATIO	14.2	14.8	15.4	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
45	AVERAGE CLASS SIZE	15.2	16.6	18.2	20.0	21.2	22.5	24.0	24.0	24.0	24.0	24.0
94	INSTRUC AS PCT FD-GENL	34.5	49.3	50.0	50.8	52.4	53.9	55.2	56.4	57.5	58.5	59.4

LIBRARY SUMMARY REPORT SAMPLE COLLEGE OVERALL MODEL - 1 CURRENT DATE

PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
51 VOLUMES HELD	43000	45180	47439	49797	52272	54863	57571	60395	63336	66393	69567
52 PERIODICAL SUBSCRIPTIONS	200.0	242.9	285.7	328.6	371.4	414.3	457.1	500.0	500.0	500.0	500.0
58 LIBRARY EXPENSES	40714	59746	64494	69870	75936	82548	89757	97617	104905	112717	121091
99 LIBRARY AS PCT ED-GENL	3.5	4.0	4.0	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.0

EDUC AND GENERAL REPORT SAMPLE COLLEGE OVERALL MODEL - 1 CURRENT DATE

PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
INCOME EDUC AND GENL											
60 TUITION AND FEES	674000	767422	867589	981000	1108661	1243779	1386354	1536386	1693875	1858821	2031224
61 ENDOWMENT	3750	13375	23000	32625	42250	51875	61500	71125	80750	90375	100000
62 GIFTS AND GRANTS	112049	123253	135579	149137	164050	180456	198501	218351	240186	264205	290626
63 OTHER	21311	22376	23495	24670	25903	27198	28558	29986	31486	33060	34713
64 TOTAL EDUC GEN INCOME	811110	926428	1049664	1187432	1340865	1503309	1674914	1855849	2046298	2246462	2456564
76 GENERAL ADMINISTRATION	169415	176191	183239	190568	198191	206119	214364	222938	231856	241130	250775
77 STUDENT SERVICES	132400	142095	152042	162685	174073	186258	199296	213247	228175	244147	261237
78 PUBLIC RELATIONS	97450	103296	109494	116064	123028	130410	138234	146528	155320	164639	174518
79 GENL INSTITL EXPENSE	79385	81766	84219	86746	89348	92028	94789	97633	100562	103579	106686
80 INSTRUCTION	638500	739392	800493	869611	978355	1094117	1217001	1347106	1484534	1629387	1781766
81 LIBRARY	40714	59746	64494	69870	75936	82548	89757	97617	104905	112717	121091
82 PLANT OPERTN AND MAINT	187300	196664	206498	216823	227664	239047	250999	263549	276727	290563	305091
83 TOTAL EDUC-GENL EXPENSE	13455640	1499155	1600481	1712370	1866597	2030530	2204443	2388622	2582081	2786166	3001168

AUXILIARIES REPORT SAMPLE COLLEGE OVERALL MODEL - 1 CURRENT DATE

PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
				AUXILIARY ENTRSE INCOME							
66 RESIDENCE HALL INCOME	492000	526077	566078	611354	661730	712581	763716	832788	904847	979894	1057929
67 BOOKSTORE	106200	117729	131765	148531	168339	190366	214840	242012	272156	305575	342598
68 OTHER	3920	4115	4321	4537	4764	5003	5253	5515	5791	6081	6385
69 TOTAL AUXILIARY INCOME	602120	647923	702165	764423	834834	907951	983810	1080316	1182796	1291551	1406913
				AUXILIARIES							
86 RESIDENCE HALL EXPENSE	442800	473469	509470	550219	595557	641323	687345	749509	814363	881905	952136
86 BOOKSTORE	88146	97715	109365	123280	139721	158004	178317	200870	225890	253627	284356
87 OTHER	3920	4115	4321	4537	4764	5003	5253	5515	5791	6081	6385
88 TOTAL AUXILIARY EXPENSE	534866	575301	623157	678037	740043	804331	870916	955895	1046044	1141614	1242878

FINANCIAL AID REPORT SAMPLE COLLEGE OVERALL MODEL - 1 CURRENT DATE

PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
STUDENT AID INCOME											
71 ENDOWED STUDENT AID	53710	59080	64989	71488	78636	86500	95150	104665	115132	126645	139309
72 SPECIAL GIFTS	29020	33372	38378	44135	50756	58369	67125	77193	88772	102088	117402
73 TOTAL AID INCOME	83730	92453	103368	115623	129392	144870	162275	181859	203904	228734	256711
89 STUDENT FINANCIAL AID EXP	150984	165075	182375	202009	224183	248490	275170	306280	340656	378671	420746
103 FIN AID AS DOLLARS PER STU	213.0	227.1	242.2	257.0	271.8	287.7	304.9	325.3	347.5	371.6	397.7
105 SCHOLARSHIP ENDOW CORPUS	1074200	1181619	1299781	1429760	1572736	1730009	1903010	2093311	2302643	2532907	2786198

FISCAL SUMMARY REPORT SAMPLE COLLEGE OVERALL MODEL - 1 CURRENT DATE

	PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
64	TOTAL EDUC GEN INCOME	811110	926428	1049664	1187432	1340865	1503309	1674914	1855849	2046298	2244462	2456564
69	TOTAL AUXILIARY INCOME	603120	647923	702165	764423	834834	907951	983810	1080315	1182796	1291551	1406913
73	TOTAL AID INCOME	83730	92453	103368	115623	129392	144870	162275	181859	203904	228734	256711
74	TOTAL CURRENT INCOME	1496960	1666805	1855197	2067479	2305093	2556130	2821001	3118026	3432999	3766748	4120189
83	TOTAL EDUC-GENL EXPENSE	13455640	1499155	1600481	1712370	1866597	2030530	2204443	2388622	25820R1	2786166	3001168
88	TOTAL AUXILIARY EXPENSE	534966	575301	623157	678037	740043	804331	870916	955895	1046044	1141614	1242878
89	STUDENT FINANCIAL AID EXP	150984	165075	182375	202009	224183	248490	275170	306280	340656	378671	420746
90	TOTAL CURRENT EXPENSE	2031414	2239532	2406015	2592417	2830825	3083352	3350529	3650798	3968783	4306451	4664793
91	CURRENT OPERATING SURPLUS	-534454	-572726	-550817	-524937	-525731	-527221	-529528	-532772	-535783	-539703	-544603
92	ACCUMULATED SURPLUS	-534454	-1107180	-1657998	-2182935	-2708667	-3235889	-3765417	-4298190	-4833973	-5373677	-5918281

SIGNIFICANT FACTORS REPORT SAMPLE COLLEGE OVERALL MODEL - 1 CURRENT DATE

PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2 FRESHMEN FALL HEAD COUNT	300.0	315.0	330.0	345.0	360.0	375.0	390.0	405.0	420.0	435.0	450.0
13 TOTAL FALL HEAD COUNT	779	798	827	863	906	949	991	1034	1077	1119	1162
17 TOTAL FALL FTE ENROLLMENT	708	726	753	786	824	863	902	941	980	1019	1057
23 TUITION FEES PER YEAR	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
24 ROOM-BOARD PER YEAR	800	850	900	950	1000	1050	1100	1150	1200	1250	1300
25 BOOKS-SUPPLIES PER YEAR	150.0	162.0	175.0	189.0	204.1	220.4	238.0	257.1	277.6	299.9	323.9
26 TOTAL STUDENT COSTS / YR	1950	2111	2274	2438	2604	2770	2938	3107	3277	3449	3623
28 STUDENT FACULTY RATIO	14.2	14.8	15.4	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
29 FTE FACULTY-TEACHING	50.0	49.1	48.9	49.1	51.6	54.0	56.4	58.8	61.3	63.7	66.1
40 AVG FACULTY SALARY	9400	10110	10820	11530	12240	12950	13660	14370	15080	15790	16500
41 FRINGES AS PCT SALARY	8.5	9.1	9.8	10.4	11.1	11.7	12.4	13.0	13.7	14.3	15.0
74 TOTAL CURRENT INCOME	1496960	1666805	1855197	2067479	2305093	2556130	2821001	3118026	3432999	3766748	4120189
90 TOTAL CURRENT EXPENSE	2031414	2239532	2406015	2592417	2830825	3083352	3350529	3658798	3968783	4306451	4664793
91 CURRENT OPERATING SURPLUS	-534454	-572726	-550817	-524937	-525731	-527221	-529528	-532772	-535783	-539703	-544603
92 ACCUMULATED SURPLUS	-534454	-1107180	-1657998	-2182935	-2708667	-3235889	-3765417	-4298190	-4833973	-5373677	-5918281
101 PCT ED-GENL PAID BY FEES	50.1	51.2	54.2	57.3	59.4	61.3	62.9	64.3	65.6	66.7	67.7
104 GEN ENDOWMENT CORPUS	75000	267500	460000	652500	845000	1037500	1230000	1422500	1615000	1807500	2000000
105 SCHOLARSHIP ENDOW CORPUS	1074200	1191619	1299781	1429760	1572736	1730009	1903010	2093311	2302643	2532907	2786198

ANALYSIS SUMMARY REPORT SAMPLE COLLEGE OVERALL MODEL - 1 CURRENT DATE

PLANNING ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
94 GEN ADMIN AS PCT ED-GEN	12.6	11.8	11.4	11.1	10.6	10.2	9.7	9.3	9.0	8.7	8.4
95 STUD SERV AS PCT ED-GENL	9.8	9.5	9.5	9.5	9.3	9.2	9.0	8.9	8.8	8.8	8.7
96 PUB REL AS PCT ED-GENL	7.3	6.9	6.8	6.8	6.6	6.4	6.3	6.1	6.0	5.9	5.8
97 GEN INST AS PCT ED-GENL	5.9	5.5	5.3	5.1	4.8	4.5	4.3	4.1	3.9	3.7	3.6
98 INSTRUC AS PCT ED-GENL	38.5	49.3	50.0	50.8	52.4	53.9	55.2	56.4	57.5	58.5	59.4
99 LIBRARY AS PCT ED-GENL	3.5	4.0	4.0	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.0
100 PLANT AS PCT ED-GENL	14.2	13.1	12.9	12.7	12.2	11.8	11.4	11.0	10.7	10.4	10.2
101 PCT ED-GENL PAID BY FEES	50.1	51.2	54.2	57.3	59.4	61.3	62.9	64.3	65.6	66.7	67.7
102 FIN AID AS PCT STU FEES	22.6	21.5	21.0	20.6	20.2	20.0	19.8	19.9	20.1	20.4	20.7
103 FIN AID AS DOLLARS PER STU	213.0	227.1	242.2	257.0	271.8	287.7	304.9	325.3	347.5	371.6	397.7
104 GEN ENDOWMENT CORPUS	75000	267500	460000	652500	845000	1037500	1230000	1422500	1615000	1807500	2000000
105 SCHOLARSHIP ENDOW CORPUS	1074200	1181619	1299781	1429760	1572736	1730009	1903010	2093311	2302643	2532907	2786198

ANALYSIS OF PLANNING MATRIX SAMPLE COLLEGE CURRENT DATE
OVERALL MODEL - 1

LINE	CH	PLANNING ITEM	BASE	CODE	METHOD OF COMPUTATION	TOTALS
1	-0	STUDENTS				
2	-0	FRESHMEN FALL HEAD COUNT	300.0	3	INCREASE 15.00/YR	ADD INTO 13
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		300.0 315.0 330.0 345.0 360.0 375.0 390.0 405.0 420.0 435.0 450.0				
3	-0	POTENTIAL SOPH	-0.0	7	0.00X DIAGONAL OF LINE 2	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		-0.0 300.0 315.0 330.0 345.0 360.0 375.0 390.0 405.0 420.0 435.0				
4	-0	PCT RETENTION FR-SOPH	60.0	2	INCREASE 0.00 PCT PER YR	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		60.0 60.0 60.0 60.0 60.0 60.0 60.0 60.0 60.0 60.0 60.0				
5	-0	SOPHOMORES FALL HEAD COUNT	180.0	6	0.00L 3* .01L 4 0.00 0 0.00 0	ADD INTO 13
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		180.0 180.0 189.0 198.0 207.0 216.0 225.0 234.0 243.0 252.0 261.0				
6	-0	POTENTIAL JRS	-0.0	7	0.00X DIAGONAL OF LINE 5	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		-0.0 180.0 189.0 198.0 207.0 216.0 225.0 234.0 243.0 252.0				
7	-0	PCT RETENTION SO-JR	80.0	2	INCREASE 0.00 PCT PER YR	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		80.0 80.0 80.0 80.0 80.0 80.0 80.0 80.0 80.0 80.0 80.0				
8	-0	JUNIORS FALL HEAD COUNT	144.0	6	0.00L 6* .01L 7 0.00 0 0.00 0	ADD INTO 13
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		144.0 144.0 144.0 151.2 158.4 165.6 172.8 180.0 187.2 194.4 201.6				
9	-0	POTENTIAL SENIORS	-0.0	7	0.00X DIAGONAL OF LINE 8	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		-0.0 144.0 144.0 144.0 151.2 158.4 165.6 172.8 180.0 187.2 194.4				
10	-0	PCT RETENTION JR-SR	90.0	2	INCREASE 0.00 PCT PER YR	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		90.0 90.0 90.0 90.0 90.0 90.0 90.0 90.0 90.0 90.0 90.0				
11	-0	SENIORS FALL HEAD COUNT	130.0	6	0.00L 9* .01L 10 0.00 0 0.00 0	ADD INTO 13
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		130.0 129.6 129.6 129.6 136.1 142.6 149.0 155.5 162.0 168.5 175.0				
12	-0	SPECIAL AND UNCLASSIFIED	25.0	3	INCREASE 5.00/YR	ADD INTO 13
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		25.0 30.0 35.0 40.0 45.0 50.0 55.0 60.0 65.0 70.0 75.0				

ANALYSIS OF PLANNING MATRIX SAMPLE COLLEGE CURRENT DATE
OVERALL MODEL - 1

LINE CH	PLANNING ITEM	BASE	CODE	METHOD OF COMPUTATION	TOTALS
13 -0	TOTAL FALL HEAD COUNT	779.0	1	TOTAL FROM OTHER LINES	ADD INTO -0
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	779 798 827 863 906 949 991 1034 1077 1119 1162				
14 -0	FULL TIME	660.0	6	.85L 13 0.00 0 0.00 0 0.00 0	ADD INTO 17
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	660.0 678.8 703.5 734.2 770.5 806.3 843.1 879.3 915.6 951.9 988.2				
15 -0	PART TIME	119.0	6	0.00L 13- 0.00L 14 0.00 0 0.00 0	ADD INTO -0
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	119.0 119.8 124.1 129.6 136.0 142.4 148.8 155.2 161.6 168.0 174.4				
16 -0	FTE OF PART TIME	48.0	6	.40L 15 0.00 0 0.00 0 0.00 0	ADD INTO 17
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	48.0 47.9 49.7 51.9 54.4 56.9 59.5 62.1 64.6 67.2 69.8				
17 -0	TOTAL FALL FTE ENROLLMENT	708.0	1	TOTAL FROM OTHER LINES	ADD INTO -0
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	708 726 753 786 824 863 902 941 980 1019 1057				
18 -0	RESIDENTS AS PCT HEAD CONT	79.0	4	CHANGE TO 70.00 IN 6 YRS	ADD INTO -0
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	79.0 77.5 76.0 74.5 73.0 71.5 70.0 70.0 70.0 70.0 70.0				
19 -0	RESIDENT STUDENTS	615.0	6	.01L 18* 0.00L 13 0.00 0 0.00 0	ADD INTO -0
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	615.0 618.9 629.0 643.5 661.7 678.6 694.3 724.2 754.0 783.9 813.8				
20 -0	RESIDENT MEN	370.0	6	.60L 19 0.00 0 0.00 0 0.00 0	ADD INTO -0
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	370.0 371.3 377.4 386.1 397.0 407.2 416.6 434.9 452.4 470.3 488.3				
21 -0	RESIDENT WOMEN	245.0	6	0.00L 19- 0.00L 20 0.00 0 0.00 0	ADD INTO -0
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	245.0 247.6 251.6 257.4 264.7 271.5 277.7 289.7 301.6 313.6 325.5				
22 -0	COMMUTING STUDENTS	164.0	6	0.00L 13- 0.00L 19 0.00 0 0.00 0	ADD INTO -0
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	164.0 179.7 198.6 220.3 244.7 270.5 297.6 310.4 323.2 336.0 348.8				
23 -0	TUITION FEES PER YEAR	1000.0	3	INCREASE 100.00/YR	ADD INTO 26
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000				
24 -0	ROOM-BOARD PER YEAR	800.0	3	INCREASE 50.00/YR	ADD INTO 26
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	800 850 900 950 1000 1050 1100 1150 1200 1250 1300				

ANALYSIS OF PLANNING MATRIX — SAMPLE COLLEGE — CURRENT DATE

OVERALL MODEL - 1

LINE	CH	PLANNING ITEM	BASE	CODE	METHOD OF COMPUTATION	TOTALS
25	-0	BOOKS-SUPPLIES PER YEAR	150.0	2	INCREASE 8.00 PCT PER YR	ADD INTO 26
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		150.0 162.0 175.0 189.0 204.1 220.4 238.0 257.1 277.6 299.9 323.8				
26	-0	TOTAL STUDENT COSTS / YR	1950	1	TOTAL FROM OTHER LINES	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		1950 2111 2274 2438 2604 2770 2938 3107 3277 3449 3623				
27	-0	FACULTY				
28	-0	STUDENT FACULTY RATIO	14.2	4	CHANGE TO 16.00 IN 3 YRS	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		14.2 14.8 15.4 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0				
29	-0	FTE FACULTY-TEACHING	50.0	6	0.00L 17/ 0.00L 28 0.00 0 0.00 0	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		50.0 49.1 48.9 49.1 51.6 54.0 56.4 58.8 61.3 63.7 66.1				
30	-0	INSTRUCTORS AS PCT FTE	32.0	2	INCREASE 0.00 PCT PER YR	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		32.0 32.0 32.0 32.0 32.0 32.0 32.0 32.0 32.0 32.0 32.0				
31	-0	ASST AS PCT FTE	28.0	2	INCREASE 0.00 PCT PER YR	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		28.0 28.0 28.0 28.0 28.0 28.0 28.0 28.0 28.0 28.0 28.0				
32	-0	ASSOC AS PCT OF FTE	18.0	2	INCREASE 0.00 PCT PER YR	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		18.0 18.0 18.0 18.0 18.0 18.0 18.0 18.0 18.0 18.0 18.0				
33	-0	PROF AS PCT FTE	22.0	2	INCREASE 0.00 PCT PER YR	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		22.0 22.0 22.0 22.0 22.0 22.0 22.0 22.0 22.0 22.0 22.0				
34	-0	INSTRUCTORS	16.0	6	.01L 30* 0.00L 29 0.00 0 0.00 0	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		16.0 15.7 15.6 15.7 16.5 17.3 18.1 18.8 19.6 20.4 21.2				
35	-0	ASSISTANT PROFESSORS	14.0	6	.01L 31* 0.00L 29 0.00 0 0.00 0	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		14.0 13.7 13.7 13.8 14.4 15.1 15.8 16.5 17.2 17.8 18.5				
36	-0	ASSOCIATE PROFESSORS	9.0	6	.01L 32* 0.00L 29 0.00 0 0.00 0	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		9.0 [illegible] [illegible] [illegible] 9.3 9.7 10.2 10.6 11.0 11.5 11.9				

ANALYSIS OF PLANNING MATRIX — SAMPLE COLLEGE — CURRENT DATE

OVERALL MODEL - 1

LINE	CH	PLANNING ITEM	BASE	CODE	METHOD OF COMPUTATION	TOTALS
37	-0	FULL PROFESSORS	11.0	6	.01L 33* 0.00L 29 0.00 0 0.00 0	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		11.0 10.8 10.8 10.8 11.3 11.9 12.4 12.9 13.5 14.0 14.5				
38	-0	FTE FACULTY ON SABBATICAL	4.0	3	INCREASE .50/YR	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0				
39	-0	TOTAL FACULTY-BUDGET	54.0	6	0.00L 29+ 0.00L 38 0.00 0 0.00 0	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		54.0 53.6 53.9 54.6 57.6 60.5 63.4 66.3 69.3 72.2 75.1				
40	-0	AVG FACULTY SALARY	9400	4	CHANGE TO 16500.00 IN 10 YRS	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		9400 10110 10820 11530 12240 12950 13660 14370 15080 15790 16500				
41	-0	FRINGES AS PCT SALARY	8.5	4	CHANGE TO 15.00 IN 10 YRS	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		8.5 9.1 9.8 10.4 11.1 11.7 12.4 13.0 13.7 14.3 15.0				
42	-0	FRINGES IN DOLLARS	800.0	6	.01L 41* 0.00L 40 0.00 0 0.00 0	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		800 925 1060 1204 1358 1521 1693 1875 2065 2265 2474				
43	-0	AVERAGE FACULTY COMPENSATION	10200	6	0.00L 40+ 0.00L 42 0.00 0 0.00 0	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		10200 11035 11880 12734 13598 14471 15353 16245 17145 18055 18974				
44	-0	AVG FACULTY LOAD CREDIT HRS	14.0	4	CHANGE TO 10.00 IN 6 YRS	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		14.0 13.3 12.7 12.0 11.3 10.7 10.0 10.0 10.0 10.0 10.0				
45	-0	AVERAGE CLASS SIZE	15.2	6	15.00L 17/ 0.00L 29/ 0.00L 44 0.00 0	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		15.2 16.6 18.2 20.0 21.2 22.5 24.0 24.0 24.0 24.0 24.0				
46	-0	TOTAL FACULTY COSTS	510800	6	0.00L 39* 0.00L 43 0.00 0 0.00 0	ADD INTO 48
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		510800 591513 640394 695689 782684 875294 973600 1077684 1187627 1303510 1425413				
47	-0	INSTRUCTIONAL SUPPORT	127700	6	.25L 46 0.00 0 0.00 0 0.00 0	ADD INTO 48
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		127700 147878 160098 173922 195671 218823 243400 269421 296906 325877 356353				
48	-0	TOTAL INSTRUCTIONAL COSTS	638500	1	TOTAL FROM OTHER LINES	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		638500 738432 800493 869611 978355 1094117 1217001 1347106 1484534 1629387 1781766				

ANALYSIS OF PLANNING MATRIX SAMPLE COLLEGE CURRENT DATE

OVERALL MODEL - 1

LINE CH	PLANNING ITEM	BASE	CODE	METHOD OF COMPUTATION	TOTALS
49 -0	LIBRARY				
50 -0	VOLUMES ADDED	43000	6	3.00L 17 0.00 0 0.00 0 0.00 0 ADD INTO -0	
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	43000 2189 2259 2358 2474 2591 2707 2824 2940 3057 3173				
51 -0	VOLUMES HELD	43000	9	ACCUMULATIVE SUM OF LINE 50	ADD INTO -0
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	43000 45189 47439 49797 52272 54863 57571 60395 63336 66393 69567				
52 -0	PERIODICAL SUBSCRIPTIONS	200.0	4	CHANGE TO 500.00 IN 7 YRS	ADD INTO -0
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	200.0 242.9 285.7 328.6 371.4 414.3 457.1 500.0 500.0 500.0 500.0				
53 -0	BOOK COST PER VOLUME	8.0	2	INCREASE 6.00 PCT PER YR	ADD INTO -0
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	8.0 8.5 9.0 9.5 10.1 10.7 11.3 12.0 12.8 13.5 14.3				
54 -0	PERIODICAL COST PER SUBSCRPT	14.0	2	INCREASE 10.00 PCT PER YR	ADD INTO -0
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	14.0 15.4 16.9 18.6 20.5 22.5 24.8 27.3 30.0 33.0 36.3				
55 -0	COST OF BOOKS PURCHASED	2124	6	0.00L 50* 0.00L 53 0.00 0 0.00 0 ADD INTO 58	
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	2124 18487 20308 22468 24993 27740 30727 33972 37496 41321 45470				
56 -0	SUBSCRIPTION COSTS	2800	6	0.00L 52* 0.00L 54 0.00 0 0.00 0 ADD INTO 58	
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	2800 3739 4839 6122 7613 9340 11337 13641 15005 16505 18156				
57 -0	ADMINISTRATION AND SERV	35790	6	.75L 51* 5.00L 17 0.00 0 0.00 0 ADD INTO 58	
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	35790 37518 39345 41278 43328 45466 47691 50003 52403 54890 57465				
58 -0	LIBRARY EXPENSES	40714	1	TOTAL FROM OTHER LINES	ADD INTO -0
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	40714 59746 64494 69870 75936 82548 89757 97617 104905 112717 121091				
59 -0	INCOME EDUC AND GENL				
60 -0	TUITION AND FEES	674000	6	.96L 23* 0.00L 17 0.00 0 0.00 0 ADD INTO 64	
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	674000 757422 857589 981000 1108661 1243779 1346354 1536386 1693875 1858821 2031224				

LINE	CH	PLANNING ITEM	BASE	CODE	METHOD OF COMPUTATION	TOTALS
61	-0	ENDOWMENT	3750	4	CHANGE TO 100000.00 IN 10 YRS	ADD INTO 64
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		3750 13375 23000 32625 42250 51875 61500 71125 80750 90375 100000				
62	-0	GIFTS AND GRANTS	112049	2	INCREASE 10.00 PCT PER YR	ADD INTO 64
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		112049 123253 135579 149137 164050 180456 198501 218351 240186 264205 290626				
63	-0	OTHER	21311	2	INCREASE 5.00 PCT PER YR	ADD INTO 64
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		21311 22376 23495 24670 25903 27198 28558 29986 31486 33060 34713				
64	-0	TOTAL EDUC GEN INCOME	811110	1	TOTAL FROM OTHER LINES	ADD INTO 74
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		811110 925428 1049664 1187432 1340865 1509309 1674914 1855849 2046298 2246462 2456564				
65	-0	AUXILIARY ENTRSE INCOME				
66	-0	RESIDENCE HALL INCOME	492000	6	0.00L 19* 0.00L 24 0.00 0 0.00 0	ADD INTO 69
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		492000 526077 566078 611354 661730 712581 763716 832788 904847 979894 1057929				
67	-0	BOOKSTORE	106200	6	0.00L 17* 0.00L 25 0.00 0 0.00 0	ADD INTO 69
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		106200 117729 131765 148531 168339 190366 214840 242012 272156 305575 342598				
68	-0	OTHER	3920	2	INCREASE 5.00 PCT PER YR	ADD INTO 69
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		3920 4115 4321 4537 4764 5003 5253 5515 5791 6081 6385				
69	-0	TOTAL AUXILIARY INCOME	602120	1	TOTAL FROM OTHER LINES	ADD INTO 74
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		602120 647923 702165 764423 834834 907951 983810 1080316 1182796 1291551 1406913				
70	-0	STUDENT AID INCOME				
71	-0	ENDOWED STUDENT AID	53710	2	INCREASE 10.00 PCT PER YR	ADD INTO 73
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		53710 59080 64989 71488 78636 86500 95150 104665 115132 126645 139309				
72	-0	SPECIAL GIFTS	29020	2	INCREASE 15.00 PCT PER YR	ADD INTO 73
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		29020 33372 38378 44135 50756 58369 67125 77193 88772 102088 117402				

ANALYSIS OF PLANNING MATRIX — SAMPLE COLLEGE — CURRENT DATE

OVERALL MODEL - 1

LINE CD	PLANNING ITEM	BASE	CODE	METHOD OF COMPUTATION	TOTALS
73 -0	TOTAL AID INCOME	83730	1	TOTAL FROM OTHER LINES	ADD INTO 74
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	83730 92453 103368 115623 129392 144870 162275 181859 203904 228734 256711				
74 -0	TOTAL CURRENT INCOME	1496960	1	TOTAL FROM OTHER LINES	ADD INTO -9
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	1496960 1664905 1855197 2067479 2305093 2556130 2821001 3118026 3432999 3766748 4120189				
75 -0	EXPENSE-EDUCTNL AND GENL				
76 -0	GENERAL ADMINISTRATION	169415	2	INCREASE 4.00 PCT PER YR	ADD INTO 83
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	169415 176191 183239 190568 198191 206119 214364 222938 231856 241130 250775				
77 -0	STUDENT SERVICES	132800	2	INCREASE 7.00 PCT PER YR	ADD INTO 83
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	132800 142095 152042 162685 174073 186258 199296 213247 228175 244147 261237				
78 -0	PUBLIC RELATIONS	97450	2	INCREASE 6.00 PCT PER YR	ADD INTO 83
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	97450 103296 109494 116064 123028 130410 138234 146528 155320 164639 174518				
79 -0	GEN. INSTITL EXPENSE	79385	2	INCREASE 3.00 PCT PER YR	ADD INTO 83
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	79385 81766 84219 86746 89348 92024 94789 97633 100562 103579 106686				
80 -0	INSTRUCTION	638500	6	0.00L 48 0.00 0 0.00 0 0.00 0 ADD INTO 83	
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	638500 733332 800443 869611 978355 1094117 1217001 1347105 1484534 1629387 1781766				
81 -0	LIBRARY	40714	6	0.00L 58 0.00 0 0.00 0 0.00 0 ADD INTO 83	
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	40714 54746 64494 69870 75936 82544 89757 97617 104905 112717 121091				
82 -0	PLANT OPERTN AND MAINT	187300	2	INCREASE 5.00 PCT PER YR	ADD INTO 83
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	187300 196664 206498 216823 227664 239047 250999 263549 276727 290563 305091				
83 -0	TOTAL EDUC-GENL EXPENSE	13455640	1	TOTAL FROM OTHER LINES	ADD INTO 90
	BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
	13455640 1499155 1680481 1712370 1866547 2030530 2204443 2388622 2582091 2786166 3001163				
84 -0	AUXILIARIES				

LINE	CH	PLANNING ITEM	BASE	CODE	METHOD OF COMPUTATION	TOTALS
85	-0	RESIDENCE HALL EXPENSE	442800	6	.90L 66 0.00 0 0.00 0 0.00 0	ADD INTO 88
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		442800 473469 509470 550219 595557 641323 687345 749509 814363 881905 952136				
86	-0	BOOKSTORE	88146	6	.83L 67 0.00 0 0.00 0 0.00 0	ADD INTO 88
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		88146 97715 109365 123280 139721 158004 178317 200870 225890 253627 284356				
87	-0	OTHER	3920	6	0.00L 68 0.00 0 0.00 0 0.00 0	ADD INTO 88
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		3920 4115 4321 4537 4764 5003 5253 5515 5791 6081 6385				
88	-0	TOTAL AUXILIARY EXPENSE	534866	1	TOTAL FROM OTHER LINES	ADD INTO 90
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		534866 575301 623157 678037 740043 804331 870916 955895 1046044 1141614 1242878				
89	-0	STUDENT FINANCIAL AID EXP	150984	6	0.00L 69- 0.00L 88+ 0.00L 73 0.00 0	ADD INTO 90
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		150984 165075 182375 202009 224183 248490 275170 306280 340656 378671 420746				
90	-0	TOTAL CURRENT EXPENSE	2031414	1	TOTAL FROM OTHER LINES	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		2031414 2234532 2406015 2592417 2830825 3083352 3350529 3650798 3968783 4306451 4664793				
91	-0	CURRENT OPERATING SURPLUS	-534454	6	0.00L 74- 0.00L 90 0.00 0 0.00 0	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		-534454 -572726 -550817 -524937 -525731 -527221 -529529 -532772 -535783 -539703 -544603				
92	-0	ACCUMULATED SURPLUS	-534454	9	ACCUMULATIVE SUM OF LINE 91	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		-534454 -1107180 -1657996 -2182935 -2708667 -3235889 -3765417 -4298190 -4833973 -5373677 -5918281				
93	-0	ANALYSIS				
94	-0	GEN ADMIN AS PCT ED-GEN	12.6	6	0.00L 76/ .01L 83 0.00 0 0.00 0	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		12.6 11.8 11.4 11.1 10.6 10.2 9.7 9.3 9.0 8.7 8.4				
95	-0	STUD SERV AS PCT ED-GENL	9.8	6	0.00L 77/ .01L 83 0.00 0 0.00 0	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		9.8 9.5 9.5 9.5 9.3 9.2 9.0 8.9 8.8 8.8 8.7				
96	-0	PUB REL AS PCT ED-GENL	7.3	6	0.00L 78/ .01L 83 0.00 0 0.00 0	ADD INTO -0
		BASE 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979				
		7.3 6.9 6.8 6.8 6.6 6.4 6.3 6.1 6.0 5.9 5.8				

ANALYSIS OF PLANNING MATRIX — SAMPLE COLLEGE — CURRENT DATE

OVERALL MODEL - 1

LINE CH	PLANNING ITEM	BASE	CODE	METHOD OF COMPUTATION					TOTALS
97 -0	GEN INST AS PCT ED-GENL	5.9	6	0.00L 79/	.01L 83	0.00 0	0.00 0	ADD INTO -0	
	BASE 1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
	5.9 5.5	5.3	5.1	4.8	4.5	4.3	4.1	3.9	3.7	3.6
98 -0	INSTRUC AS PCT ED-GENL	38.5	6	0.00L 80/	.01L 83	0.00 0	0.00 0	ADD INTO -0	
	BASE 1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
	38.5 49.3	50.0	50.8	52.4	53.9	55.2	56.4	57.5	58.5	59.4
99 -0	LIBRARY AS PCT ED-GENL	3.5	6	0.00L 81/	.01L 83	0.00 0	0.00 0	ADD INTO -0	
	BASE 1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
	3.5 4.0	4.0	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.0
100 -0	PLANT AS PCT ED-GENL	14.2	6	0.00L 82/	.01L 83	0.00 0	0.00 0	ADD INTO -0	
	BASE 1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
	14.2 13.1	12.9	12.7	12.2	11.9	11.4	11.0	10.7	10.4	10.2
101 -0	PCT ED-GENL PAID BY FEES	50.1	6	0.00L 60/	.01L 83	0.00 0	0.00 0	ADD INTO -0	
	BASE 1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
	50.1 51.2	54.2	57.3	59.4	61.3	62.9	64.3	65.6	66.7	67.7
102 -0	FIN AID AS PCT STU FEES	22.6	6	0.00L 89/	.01L 60	0.00 0	0.00 0	ADD INTO -0	
	BASE 1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
	22.6 21.5	21.0	20.6	20.2	20.0	19.8	19.9	20.1	20.4	20.7
103 -0	FIN AID AS DOLLARS PER STU	213.0	6	0.00L 89/	0.00L 17	0.00 0	0.00 0	ADD INTO -0	
	BASE 1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
	213.0 227.1	242.2	257.0	271.8	287.7	304.9	325.3	347.5	371.6	397.7
104 -0	GEN ENDOWMENT CORPUS	75000	6	20.00L 61	0.00 0	0.00 0	0.00 0	ADD INTO -0	
	BASE 1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
	75000 267500	460000	652500	845000	1037500	1230000	1422500	1615000	1807500	2000000
105 -0	SCHOLARSHIP ENDOW CORPUS	1074200	6	20.00L 71	0.00 0	0.00 0	0.00 0	ADD INTO -0	
	BASE 1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
	1074200 1181619	1299781	1429760	1572736	1730009	1903010	2093311	2302643	2532907	2786198

APPENDIX C

ERROR MESSAGES AND COMMON DATA ERRORS

ERROR MESSAGES AND COMMON DATA ERRORS

The planning system concept permits the planner great flexibility in the development of models. Since the ability to establish relationships between planning items is generalized and almost unlimited, the chance for making errors also exists.

This appendix explains the error messages that the planning system will generate if errors are made. This appendix also identifies common errors and describes the techniques that will correct the errors.

Error Messages

1. "WARNING, WE HAVE GONE THROUGH 100 ITERATIONS AND HAVE BEEN FORCED."

This message appears when the model contains flaws in logic. These flaws usually result in the inability of the system to calculate certain planning item lines. To correct these errors, you should keep in mind that the system cannot generate or project any planning item that depends upon other planning items until all those other planning items have been projected. For example, if Line 7 "Student-Faculty Ratio" depends on Line 18 "Total Students" and Line 22 "Total Faculty," Line 7 cannot be projected until both Line 18 and Line 22 have been projected. Therefore, it may be helpful to look through the Analysis of Planning Matrix (the reports may not contain the critical lines) If a planning item is found with zeros projected across the planning horizon, check the instruction for the generation of that planning item to be certain that the instruction is correct, in the proper format, and that the lines upon which this line depends, if any, are present and correct.

This process of tracing through the relationships of the planning items, both to the lines they are dependent upon and to the lines that depend on them should identify the source of the error. Correct the error and resubmit the job.

2. "THERE IS A ONE LINE COMPARISON ERROR IN LINE ___."

This message occurs when a Code 8 (maximum or minimum of other lines) is used, but only one line is specified. The system will continue as best it can. To correct, examine all planning items that use a Code 8 and identify the one that exhibits only a single line. Insert the other line, or lines, to be examined. Resubmit the run.

ERIC

3. "LINE ___ HAS BEEN DROPPED. THE NUMBER ASSIGNED TO THE LINE ITEM MUST NOT EXCEED (nnn). PLEASE RENAME."

This message is self-explanatory. It is a reminder that a line number has been encountered that exceeds the upper limit (nnn) for the particular computer being used. The limit of lines is dependent upon the version of the planning system that has been installed on a particular computer. To correct this error, examine the specified line number identified by the message. Either the line must be renumbered, or the model must be reduced to the maximum size permitted. In many cases, this error message is the result of the incorrect placement of the line number in the line number field; that is, if the line number has not been right-adjusted. this error message will be printed, because blanks in the fields are read as zeros. For example, if the line number field, Columns 1-3, contains "85 blank," the line number is read as 850. Changing the field to read "blank 85" would correct this error.

Common Errors

1. Logical loop error: If no obvious errors can be found by examining the individual planning items, search through the chain of dependency of the zero value lines to ensure that there is not a logical loop among the planning items. For example, a condition in which Line 1 depends on Lines 2 and 3; and Line 2 depends on Lines 10, 11, and 12; and Line 12 depends on Line 1 is a logical loop error because it is a logically impossible condition. To correct this error, restructure the model so that the loop is eliminated.

2. Summary error: A difficult error to spot is one involving a Code 1 (summary of other lines). If a line has zero values and is dependent on a Code 1 planning item that has values in the planning horizon, examine the Code 1 planning item to ensure that all specified lines have been totaled. The Code 1 planning item may reflect values in the planning horizon, and still not be completed. The most frequent cause of this error is that a heading line has been specified as being included in the summary line, or that other lines have been summed into a planning item that does not reflect a Code 1. To correct this error, make changes in the planning items to reflect the correct relationship.

3. Generating a planning item reflecting zero values: The planning system has no way of knowing whether a line is completed other than checking whether or not any value in the planning horizon is nonzero (Code 1, "Summary" excepted). Therefore, if you want a particular planning item to appear on the report with zero values for the planning horizon, you must insert a small value (0.0001) in at least one period of the planning

horizon. Various codes could be used, and so long as at least one period contains a nonzero value, the line will be generated, and can be used in other dependent relationships. For example, this technique might be used if you desire a planning item to appear on the report, but there are not any values for the planning item at this time. The 0.0001 value will be printed on the report as a zero because of rounding. The small size of the 0.0001 eliminates its effect when used in dependent relationships with other planning items.

4. A planning item shows only the line number and the planning item name, with no values in the planning matrix: This error is caused by the code field being left blank. The blank causes the system to treat the planning item as a heading. To correct, insert the proper code and resubmit the job.

5. A planning item is not reflected in the planning matrix: This error is often caused by the duplication of the line number. The planning system will accept only one of duplicate line numbers. The other line numbers are disregarded. This problem can often be solved by listing the model input and eliminating duplication of line numbers.

GLOSSARY OF WORDS AND TERMINOLOGY

Accumulative sum	The horizontal summation of the annual values taken on by one planning item in each year of the 10-year planning horizon. Thus, if annual values for a given planning item are: 1, 1, 1, 1, 1, 1, 1, 1, 1, 1; then the accumulative sum is: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
Accumulative product	Similar to accumulative sum described above. Annual values taken on by a given planning item are multiplied horizontally across the 10-year planning horizon. Thus, if annual values are: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10; the accumulative product is: 1, 3, 9, 36, 180, 1260, 10080, 90720, 907200. This capability is useful in evaluating such phenomena as growth rate expressed as compound percentage increases.
Base level	The beginning or current level of a given planning item. The numeric value that is assigned to that item now.
Code	The one-character or one-digit symbol assigned to a particular method of projection of a planning item. The code associated with the instruction to project faculty salary by a percentage increase is--2. The computer system keys off these code indications to look for certain indicators in the following verbiage.
Constant value	A value that remains fixed throughout the time span of the planning horizon. Constant values are often used as multiplying factors in equations, i.e., Code 6 projections. Constant values may also be projected across the planning horizon as bounding values, for example.
Delimiter	In writing an instruction for a projection--a portion of the instruction is "freeform." To compensate for that lack of structure, some character must be used to separate the several parts of the instruction. For example, Code 5--the insertion of data--requires that the individual data points be separated by commas. These commas serve to delimit the fields--thus they are called delimiters.

Exercising the model	The processing of the model in computer runs. The examination of model results under various and varied alternative assumptions.
Field	A data processing term. A field is a collection of one or more contiguous characters usually in a machine sensible form and considered as one data item. Example--the Planning Item field is the collection of alphabetic, numeric, and special characters (including blanks) between card columns 5 and 32 of an instruction.
Freeform method of computation	This portion of the instruction is called freeform because the system accommodates a variety of verbiage describing how the item is to be projected. This information is unformated; that is, the model builder is not restricted to certain columns for data entry.
Input	Data, information, and instructions put into a format assembled in an appropriate fashion to be applied to the computer for processing.
Line number	A nonsymbolic number assigned to a planning item for ease in identification and internal manipulation. The line number concept is analogous to the budget line numbers.
Model	In the HELP/PLANTRAN system, a collection of planning items, identified with a verbal description as well as a unique line number and each with an associated instruction for projection of values through time. The model is a vehicle or analytic tool that aids in the prediction of how an institution or organization would react or perform under a given, hypothesized set of conditions.
Output	The product or result of a computer run usually in the form of a pre-designated report or tabulation.
Planning horizon	That period of time of interest to the planner. Ten years seems to be a common period of interest in long-range planning, although many institutions characteristically use a shorter period and for some purposes a longer period may be necessary.

ERIC

PLANTRAN	An acronym for PLANning TRANslator. An English-like language in which a planner may instruct the computer to perform calculations in order to project values of a given planning item through time.
Printout	The physical product of a computer run. A tabulation. See Output above.
Reserved character	Within the rules of the PLANTRAN language, certain characters in the "freeform method of computation" have special meaning and cause the computer to perform special calculations. Since the computer cannot perceive the context in which these characters are used, they are reserved and are not to be used except as defined in the rules of the language. See Chapter IV for a discussion of these rules.
Right adjusted	To place the rightmost character of a data item in the rightmost position in the field designated for that item. No space is left in that field following the information entered.
System driver	The facility within the HELP/PLANTRAN system to automatically step through a series of pre-designated iterations or runs examining several sets of hypotheses at one time. This capability permits the design of experiments to examine multiple alternatives simultaneously.
Variable	One planning item. Mathematically the planning items or variables are considered to be a matrix of row vectors that are either auto-generated or are functions of other row vectors. The description of a planning item along with its 10 projected values is considered to be one variable.